TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

No. 209.

JOSHUA MERRILL, APPELLANT,

vs.

DAVID M. YEOMANS AND DANIEL J. GOSS, AS D. M. YEOMANS & GOSS.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE DISTRICT OF MASSACHUSETTS.

FILED OCTOBER 23, 1874.

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1 UNITED STATES OF AMERICA,
Massachusetts District, ss:

At a circuit court of the United States for the first circuit begun and holden at Boston, within and for the district of Massachusetts, on Wednesday, the fifteenth day of October, in the year of our Lord one thousand eight hundred and seventy-three, before the honorable George F. Shepley, circuit judge.

JOSHUA MERRILL, COMPLAINANT,
v.
DAVID M. YEOMANS ET AL., DEFENDANTS. } In equity.

The bill of complaint in this cause was filed in the clerk's office on the twenty-fifth day of March, A. D. 1870, and was duly entered at the October term of this court, A. D. 1869, and is in the words and figures following, namely:

Circuit court of the United States, district of Massachusetts, in equity.

JOSHUA MERRILL
vs.
DAVID M. YEOMANS ET AL.

Bill of complaint.—Filed March 25, 1870.

To the honorable the judges of the circuit court of the United States in and for the district of Massachusetts:

Joshua Merrill, of Boston, in said district of Massachusetts, brings this his bill of complaint against David M. Yeomans, of Boston, and Daniel J. Goss, of Hyde Park, in said district, copartners, doing business in said Boston under the name of D. M. Yeomans & Goss.

And thereupon your orator complains and says that he was the original and first inventor of a new and useful improvement, fully described in the letters-patent hereinafter mentioned, the same being a new and useful improved manufacture of deodorized heavy hydrocarbon oils, which was not known before his said invention thereof, and which had not been at the time of his application for said patent in public use or on sale, with his consent and allowance, for more than two years.

And your orator further shows that he being, as aforesaid, the original and first inventor and discoverer of said improved manufacture, did, on the eighteenth day of May, in the year of our Lord one thousand eight hundred and sixty-nine, upon due application therefor, obtain letters-patent of the United States, in due form of law, under the seal of the Patent-Office of the United States, bearing date the day and year last above mentioned, and signed by the Secretary of the Interior, and countersigned by the Commissioner of Patents of the United States,
2 whereby there was granted to your orator, his heirs, administrators, and assigns, for the term of seventeen years from the date thereof, the full and exclusive right and liberty of making, using, and vending to others to be used the said improved manufacture, as by said letters-patent in court to be produced will fully appear.

And your orator further shows that the exclusive right and liberty aforesaid has been and still is of great value and profit to your orator, yet the respondents, well knowing the premises, without his consent, and in violation of said letters-patent and your orator's rights, have

sold and used, and still do sell and use, large quantities of said patented manufacture; but how much your orator cannot state, but prays that the respondents may discover and set forth; and thereby the respondents have infringed and still do infringe upon the exclusive rights and privileges so intended to be secured to your orator by the letters-patent aforesaid.

And your orator has requested the said respondents to acknowledge his rights in the premises, and to desist and refrain from using or selling said patented manufacture, and to account with and pay to your orator what is justly due to your orator by reason of said infringement.

But now so it is, may it please your honors, the said respondents wholly refuse so to do, contrary to equity and good conscience, and to the manifest wrong of your orator in the premises.

To the end, therefore, that the said respondents may, if they can, show cause why your orator should not have the relief hereinafter prayed, and may under oath, and according to their best and utmost knowledge, remembrance, information, or belief, full, true, direct, and perfect answer make to all and singular the premises, and especially may answer, discover, and set forth the quantity of deodorized heavy hydrocarbon oil sold or used by said respondents since the date of said patent; and wherein the hydrocarbon oil sold by the said respondents under the name and designation of "neutral topaz oil" differs from the manufacture patented to your orator as aforesaid, if at all.

And that the said respondents may answer the premises, and may be decreed to account for and pay to your orator all gains and profits realized from the unlawful use and sale of said improved manufacture, patented to your orator as aforesaid; and may be restrained by an injunction, to be issued out of this honorable court, from selling or
3 using any of said deodorized heavy hydrocarbon oils, or any oils substantially the same as the manufacture patented as aforesaid to your orator; and that he may be also enjoined and restrained as aforesaid during the pendency of this suit; and for such other and further relief in the premises as the nature of the case may require and to your honors shall seem meet.

May it please your honors to grant unto your orator not only writs of injunction conformable to the prayer of this bill, but also a writ of subpœna, to be directed to the said David M. Yeomans and Daniel J. Goss, commanding them at a certain time and under a certain penalty, therein to be limited, personally to be and appear before your honors and this honorable court, then and there to answer unto this bill of complaint, and to do and receive what to your honors shall seem meet in the premises.

JOSHUA MERRILL.

WALTER CURTIS,
Solicitor, and of Counsel for Complainant.

This cause was thence continued to the May term of this court, A. D. 1870, when the following answer, amendment to answer, and replication were filed, namely:

Answer.—Filed May 24, 1870.

The joint and several answer of David M. Yeomans and Daniel J. Goss, defendants, to the bill of complaint of Joshua Merrill, complainant.

These defendants, reserving all right of exception to said bill of complaint, for answer thereto, say:

1. These defendants admit, upon information and belief, that letters-

patent of the United States, dated May 18th, 1869, were issued and delivered to the said Merrill, for an "improved manufacture of deodorized heavy hydrocarbon oils," as stated in the said bill. But these defendants deny that said letters-patent were lawfully issued and delivered to the said Merrill, or that said improvement had not been in public use or on sale more than two years before his application for a patent, as set forth in said bill, or that he was the original and first inventor of the deodorized heavy hydrocarbon oil described in said letters-patent, or that he obtained any exclusive right and liberty by virtue of said letters-patent.

4 2. These defendants say, on information and belief, that the said "improved manufacture of deodorized heavy hydrocarbon oils," described in said letters patent, or a substantial and material part thereof claimed in said letters-patent as new, was, before the alleged invention thereof by the said Merrill, known to and used by George M. Gallop, of Salem, Massachusetts, at said Salem; and also at Brooklyn, New York; Eben Seacomb, of Boston Massachusetts, at said Salem; and Edward S. Thayer, of said Salem, at said Salem.

3. These defendants admit that they have sold at said Boston oil known as "neutral topaz oil," purchased by them from the manufacturers thereof, the "Eclipse Petroleum Refinery," of Pittsburg, Pennsylvania; but, upon information and belief, they deny that it is substantially such a deodorized heavy hydrocarbon oil as that described in the said letters-patent, or that it is produced by substantially the same process as that therein described, but how the said oil and the said process differ from the oil and the process described in the said letters-patent they are not informed and cannot answer.

4. And these defendants aver, upon information and belief, that the improvement patented to the complainant, as set forth in his said bill, was in public use and on sale with his consent and allowance more than two years before his application for said letters-patent.

5. And these defendants deny the infringement of said letters-patent with which they are charged in the said bill—

Without this that any other cause, matter or thing in said bill of complaint contained, material or necessary for these defendants to make answer unto, and not herein or hereby sufficiently answered, confessed, traversed, and avoided or denied, is true to the knowledge or belief of these defendants.

All which matters and things these defendants are ready and willing to aver, maintain, and prove as this honorable court shall direct, and pray to be hence dismissed with their costs.

D. M. YEOMANS.
DANIEL J. GOSS.

UNITED STATES OF AMERICA,
District of Massachusetts, ss :

At Boston, in the county of Suffolk and said district, this 23d day of May, A. D. 1870, personally appeared David M. Yeomans and

5 Daniel J. Goss, the defendants in the above-entitled suit in equity, and severally made solemn oath that they have heard read the foregoing answer by them subscribed, and know the contents thereof, and that the same so far as stated of their own knowledge are true, and that so far as they are stated on information and belief they verily believe the same to be true.

Before me.

N. AUSTIN PARKS,
Notary Public.

Amendment to answer.—Filed and allowed without further replication, Oct. 3, 1870.

And now the defendants in the above-entitled cause come and move for leave to amend their answer in said cause by adding after the words "of said Salem, at said Salem," the following: "and was described and patented in the following English patents, that is to say: Letters patent granted to Warren De La Rue, dated September 4, 1855, sealed November 23, 1855, inrolled February 28, 1856; letters-patent granted to Warren De La Rue, dated July 25, 1853, sealed October 6, 1853, inrolled January 18, 1854; letters-patent granted to William Kilgour, dated January 22, 1855, sealed March 20, 1855, inrolled July 21, 1855."

By their solicitor,

JABEZ S. HOLMES.

Replication.—Filed May 30, 1870.

This repliant, saving and reserving to himself all and all manner of advantage of exception which may be had and taken to the manifold errors, uncertainties, and insufficiencies of the answer of the said respondents, for replication thereunto saith that he doth and will aver, maintain, and prove his said bill to be true, certain, and sufficient in the law to be answered unto by the said respondents, and that the an-
6 swer of the said respondents is very uncertain, evasive, and insufficient in the law to be replied unto by this repliant; without this, that any other matter or thing in the said answer contained, material or effectual in the law to be replied unto and not herein and hereby well and sufficiently replied unto, confessed, or avoided, traversed or denied, is true; all which matters and things this repliant is ready to aver, maintain, and prove as this honorable court shall direct, and humbly prays as in and by his said bill he hath already prayed.

JOSHUA MERRILL,
By WALTER CURTIS, *Solicitor.*

6*a* This cause was thence continued from term to term to the October term of this court, A. D. 1871, when, to wit, November 13, 1871, by consent of parties, the following amendment to answer was made, namely:

Amendment to answer.

And now the defendants in the above-entitled cause come and move for leave to further amend their answer to said cause by adding after the words "inrolled July 21, 1855," in their answer as heretofore amended, the following:

"Letters-patent of the United States, granted to H. W. C. Tweddle, February 4, 1862, No. 34324, and the re-issue thereof of No. 2404, granted November 27, 1866; and also that the said improved manufac-
ture of deodorized heavy hydrocarbon oils, described in the
6*b* complainant's patent, or a substantial and material part thereof, claimed in said patent as new, was before the alleged invention thereof by the complainant known to and used by the said Tweddle, who is of Pittsburg, in the State of Pennsylvania, at Sharpsburg Bridge, near said Pittsburg, and by William Atwood, of and at Cape Elizabeth, in the State of Maine."

Also by striking out from the clause numbered 3, of their original

answer, the words "Eclipse Petroleum Refinery," and inserting in lieu thereof "Herbert W. C. Tweddle," and adding to said clause as so connected the following:

"Except that the neutral topoz oil is, as they are informed and believe, manufactured by the said Tweddle according to a process in-
6c vented by himself long before the alleged invention of the complainant, and fully described and patented in his said patent of February 4, 1862, re-issued November 27, 1866, and in letters-patent granted to him December 10, 1867, and numbered 72126."

Also, by adding to the clause numbered 4 of their original answer the following:

And also that the said letters-patent does not sufficiently specify and point out that which the complainant claims as new; and also, that the description and specification of said patent does not contain the whole truth relative to the said Merrill's alleged invention, and that it contains more than is necessary to produce the described effect, which concealment and addition made were made for the purpose of deceiving the public.

By their solicitors, BROWN & HOLMES.

6d The above amendment may be made, and without further replication.

CHAUNCEY SMITH,
Complainant's Solicitor.

NOVEMBER 13, 1871.

This cause was thence continued from term to term to the May term of this court, A. D. 1873, when publication of the evidence was ordered and the cause set down for hearing and fully heard before the honorable George F. Shepley, circuit judge, holding said court. This cause was thence continued to this present term, when, to wit, February 13, 1874, it is ordered, adjudged, and decreed that the bill of complaint in this cause be, and the same is hereby, dismissed with costs for defendants taxed at .

6e Whereupon the said Joshua Merrill claims an appeal to the Supreme Court of the United States and gives good and sufficient security that he will prosecute his appeal to effect and answer all damages and costs if he fail to make his plea good, which security is accepted by the court and said appeal is allowed accordingly.

A true record.

Attest:

JOHN G. STETSON, *Clerk.*

Bond to party on appeal.

Know all men by these presents that we, Joshua Merrill, of Boston, in the district of Massachusetts, as principal, and Samuel Downer and William B. Merrill, both of Boston, as sureties, are held and firmly bound unto David M. Yeomans and David J. Goss, defendants in a certain suit in equity hereinafter mentioned, in the full and just sum of two thousand dollars, to be paid to the said Yeomans and Goss, their certain attorneys, executors, administrators, or assigns; to which
6f payment well and truly to be made we bind ourselves, our heirs, executors, and administrators, jointly and severally, by these presents, sealed with our seals and dated the fourteenth day of September, in the year of our Lord one thousand eight hundred and seventy-four.

Whereas lately at a circuit court of the United States begun and holden at Boston, within and for the district of Massachusetts, in a suit in equity depending in said court between said Joshua Merrill, complainant, and David M. Yeomans, of said Boston, and David J. Goss, of Hyde Park, in said district, copartners doing business in said Boston under the name of D. M. Yeomans & Goss, defendants, decree was rendered against the said Merrill, and the said Merrill having obtained an appeal to remove the said cause to the Supreme Court of the United States to reverse the decree in the aforesaid suit, and a citation directed to the said Yeomans and Goss citing and admonishing them to be and appear at a Supreme Court of the United States to be holden at Washington on the second Monday of October next:

Now, the condition of the said obligation is such that if the said Merrill shall prosecute his said appeal to effect and answer all damages and costs if he fail to make his plea good, then the above obligation to be null and void; otherwise to remain in full force and virtue.

JOSHUA MERRILL. [L. S.]
SAM'L DONNER.
WM. B. MERRILL. [L. S.]

Signed, sealed, and delivered in presence of—
MALCOLM C. GREENE,
THEODORE M. PLIMPTON.

Approved:

CAUSTEN BROWNE,
Atty. for Defts.

A true copy of the bond taken by the judge at the time of allowing the appeal named in said bond, which bond is on file in the office of the clerk of the circuit court of the United States for the first circuit and district of Massachusetts.

Attest:

JOHN G. STETSON,
Clerk U. S. C. C., Mass. Dist.

6*g* At the hearing of said cause the following evidence was used, namely:

The United States of America, to all to whom these letters-patent shall come:

Whereas Joshua Merrill, of Boston, Massachusetts, has alleged that he has invented a new and useful improved manufacture of deodorized heavy hydrocarbon oils, and has made oath that he is a citizen of the United States, that he verily believes he is the original and first inventor or discover' of the said invention, and that the same hath not to his knowledge and belief been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars and presented a petition to the Commissioner of Patents praying that a patent may be issued therefor:

6*h* These are therefore to grant to the said Joshua Merrill, he executors, administrators, or assigns, for the term of seventeen years from the eighteenth day of May, one thousand eight and sixty-nine, the full and exclusive right and liberty of making, using, and vending to others to be used, the said invention, a description whereof is given in the annexed schedule and made a part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent-Office to be hereunto affixed.

Given under my hand at the city of Washington, this eighteenth day of May, in the year of our Lord one thousand eight hundred and sixty-nine, and of the Independence of the United States of America the ninety-third.

6i [L. S.]

W. T. OTTO,
Act'g Secretary of the Interior.
SAM'L F. FISHER,
Commissioner of Patents.

7 UNITED STATES PATENT-OFFICE.

Joshua Merrill, of Boston, Massachusetts. Letters-patent No. 90284, dated May 18, 1869. Improved manufacture of deodorized heavy hydrocarbon oils.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Joshua Merrill, of the city of Boston, in the county of Suffolk, and State of Massachusetts, have invented a new and improved manufacture of deodorized heavy hydrocarbon oils, suitable for lubricating oils, for curriers' use, and I do hereby declare that the following is a full and correct description thereof, and of the mode of manufacture.

My invention relates to the heavy hydrocarbon oils, which have heretofore been produced by distilling crude petroleum, or the crude oils obtained from the distillation of bituminous coals, bituminous shales, bituminous schists, asphaltum, and other substances producing hydrocarbon oils by distillation.

It has been the practice to treat such heavy oils with acids and alkalies, for the purpose of removing the disgusting odor peculiar to these oils, which renders them extremely objectionable for use in the art and for lubricating purposes.

Such processes are well known, and improve the character of the oils, but nevertheless the oils so treated have a pers agreeable smell, which makes them offensive and undesirable close, warm rooms, as in woollen manufactories.

Attempts have been made to remove the smell by filtration, with but partial success.

To make heavy hydrocarbon oils free from the characteristic unpleasant odors of heavy hydrocarbon oils, I take the heavy oils which have been separated from the lighter oils and from mechanical impurities by distillation, and, after chilling and expressing the solid paraffine, when such operation is necessary, place them in a still heated by a fire
8 underneath, and slowly and gradually raise the temperature until from ten to thirty per cent. of the contents of the still are distilled over, when the still is cooled down and the remaining contents removed.

The matters which go over to the condenser have a very foul, offensive, and disgusting odor, but the oil remaining in the still, if the operation has been properly conducted, is free from the characteristic offensive odor of hydrocarbon oils, and has no smell except a slight odor similar to that of fatty oils.

It can be mixed, in all proportions, with sperm, lard, fish oils, and

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It has been the practice to treat such heavy oils with acids and alkalies, for the purpose of removing the disgusting odor peculiar to these oils, which renders them extremely objectionable for use in the arts, and for lubricating purposes.

Such processes are well known, and improve the character of the odor of the oils, but nevertheless the oils so treated have a persistent disagreeable smell, which makes them offensive and undesirable for use in close, warm rooms, as in woollen manufactories.

Attempts have been made to remove the smell by filtration, with but partial success.

To make heavy hydrocarbon oils free from the characteristic unpleasant odors of heavy hydrocarbon oils, I take the heavy oils which have been separated from the lighter oils and from mechanical impurities by distillation, and, after chilling and expressing the solid paraffine, when such operation is necessary, place them in a still heated by a fire
8 underneath, and slowly and gradually raise the temperature until from ten to thirty per cent. of the contents of the still are distilled over, when the still is cooled down and the remaining contents removed.

The matters which go over to the condenser have a very foul, offensive, and disgusting odor, but the oil remaining in the still, if the operation has been properly conducted, is free from the characteristic offensive odor of hydrocarbon oils, and has no smell except a slight odor similar to that of fatty oils.

It can be mixed, in all proportions, with sperm, lard, fish oils, and

vegetable oils, and is so neutral in its character that it takes the odor of the oil that it is mixed with. If mixed with twenty per cent. of sperm oil it does not perceptibly change the smell of the sperm oil.

The process may be conducted in a common still, heated by fire-heat, as above mentioned, but will be facilitated and oil of lighter color produced by introducing superheated steam into the heated oil within the still, as hereinafter more fully described.

When operating by this process upon the paraffine heavy oils obtained from petroleum, bituminous coals, and shales, and substances producing paraffine oils, I carry on the distillation until the oil which comes from the condenser has a specific gravity of 36° Baumé's hydrometer, when, if the process be stopped, the remaining oil in the still is inodorous, or free from empyreumatic odors, but, by carrying on the distillation further, and raising the temperature until the oil running from the condenser has a specific gravity of 32° Baumé, the remaining oil will be thicker or more oily, and yet inodorous.

When operating upon heavy oils, made from asphaltum, I continue the distillation until the oil running over from the condenser has a specific gravity of from 28° to 25° Baumé's hydrometer.

The temperature within the still will depend upon the character of the oil acted upon, and upon the mode of working the still.

When superheated steam is used the temperature is much lower than when the operation is conducted without it, the steam materially assisting in vaporizing the matters that it is desirable to remove.

It is not practicable to specify particularly the specific gravity of the heavy oils used in my new manufacture. These oils are well known
9 to the trade, and distinguished from the light burning oils and naphthas by the term "heavy oils," their specific gravity varying greatly between the asphaltum oils and paraffine oils.

Heavy hydrocarbon-oils, produced from the same substances, vary considerably in specific gravity, by reason of the presence of more or less of the lighter oils which are always to be found mixed with them, and therefore the percentage of oil that is to be distilled over in working this process will vary considerably.

I do not assume to know the reason why the above-described process produces heavy oils from the characteristic odors of hydrocarbon-oils, but suppose that these odors arise from matters resulting from decomposition at the temperature at which the heavy oils vaporize and go over, and that these matters, after they are condensed with the heavy oils, will vaporize at a temperature lower than that required to vaporize and distil over the heavy oils, and therefore, may be separated from the heavy oils by distillation in a close still, at a temperature below that required to distil over the heavy oil, which, not being vaporized, will remain free from the odorous matters which would result from decomposition at the temperature required to vaporize it and distil it over.

In carrying on my process, I use the heavy hydrocarbon-oils for sale in the market, whether they have been treated by chemicals or not, the result of the process in either case being the same.

The accompanying drawings represent the distilling-apparatus I prefer to use in carrying out my invention:

Figure 1 being a front elevation of the still and condenser;

Figure 2, a plan view; and

Figure 3, a vertical cross-section of the still and furnace.

Letter *a* represents the still.

b, the fire-place, formed in brick-work, upon which the still is placed, the fire being applied to the bottom of the still.

c, the grate.

d, the ash-pit.

e, the outlet from the fire-place to the chimney.

f, the man-hole, for access to the interior of the still, covered by a suitable man-hole plate.

g, the goose-neck, or pipe, leading from the still to the condenser, *h*.

10 *i*, the casing surrounding the still, provided with doors, *j j j*, covering apertures in front of the casing, and lids, *k k k k*, covering circular apertures in the top of the casing, designed to be opened to admit air to the body of the still, within the casing, in order to regulate the temperature of the still, or to cool it down rapidly when the fire is removed from below.

m is a small filling-pipe, shown broken off in the drawing, but which should be connected with a pump, or a reservoir of oil, and furnished with a shut-off cock, to be closed when the still is filled.

So far, the apparatus is substantially the same as that described in the letters-patent of the United States granted to me July 30, 1861.

I will now proceed to describe an apparatus that I have since invented, for superheating steam, and applying it to the heated oil within the still, and which may be used with any still heated by a fire.

I place a perfectly-tight coil of steam-pipe, *n*, within the still, at or near the bottom, and connect one end of the coil with a steam-boiler by a pipe, n^1, which passes through the top of the still, and is furnished with a cock, n^2, to control the admission of steam to the coil.

The other end of the coil is connected with an outlet-pipe, *p*, which passes up through the top of the still.

A stop-cock, p', is placed near the open end of the outlet-pipe.

A return-pipe, *r*, connected with the outlet-pipe between the stop-cock and the still, passes down into the still, terminating in a horizontal discharge-pipe, r^1, perforated, as usual, with small holes for the escape of the superheated steam into the oil.

The return-pipe *r* has a stop-cock, r^2, to control the passage of the superheated steam from the outlet-pipe, through the return-pipe, to within the still, so that, when it is shut, no superheated steam passes into the oil.

The advantage of this arrangement of the superheating-coil and pipes is, that the steam is superheated in the coil to about the temperature of the oil it is to be applied to by the heat of the oil itself, and then

11 carried above the top of the still, through the outlet-pipe, in order that the operator may, by turning the cock p' near the open end of the outlet-pipe, discharge any water that has got into the coil, and ascertain when the steam has become sufficiently superheated before letting into the oil within the still through the return-pipe.

It is obvious that this arrangement of pipes for superheating and discharging superheated steam into the oil can be used for any operations carried on in stills, which require superheated steam of about the temperature of the contents of the still.

In carrying on my new manufacture of deodorizing heavy oils with this apparatus, I place the heavy oil to be deodorized in the still, and heat it by the fire beneath to the required temperature to commence the operation, the steam being shut off from the coil, and the outlet-cock being opened, to admit of the expulsion of any water from within the coil.

When the oil is heated to from about 220° to 300° Fahrenheit's thermometer, depending upon the boiling-points of the oils treated, which

vary greatly, I open the steam-cock carefully, and let steam pass into and through the coil, wherein it becomes rapidly superheated to about the temperature of the oil.

Having ascertained that the steam passing through the coil is sufficiently superheated, I close the outlet-cock, and then carefully open the cock in the return-pipe, and let a small amount of superheated steam pass down into the still, where it escapes, by the small openings through the pipe, into the body of the hot oil.

The superheated steam passes up through the body of the oil and over to the condenser, carrying along with it the more volatile portions of the oil, which condense and flow from the condenser into a tank provided for their reception.

I continue this operation, keeping the fire dull and moderate under the still, and the temperature slowly rising all the time, until I distil off all the volatile matters, which readily flow out with the steam, usually distilling off from twenty to thirty per cent., as the case may be.

I now draw out the fire, then shut off the steam, and leave the oil to cool in the still. When cool, it is drawn into suitable tanks, and is ready for sale and use.

12 It has been so completely divested of its fetid and pungent odors, having only a slight smell like a fatty oil, and has become so oily as to be greatly improved and increased in value as a lubricating-oil, or for any purposes it may be used, either alone or mixed with other oils.

I prefer to use superheated steam in working the above-described process, because I can work at lower temperature than by the fire-heat alone; but do not wish to confine my invention to its use in combination with the fire, because I can accomplish the same result by fire-heat alone, applied to the still, or by any known mode of heating a still, which will heat the oil sufficiently to distil over the portions of the oil necessary to be removed; but, in that case, I am obliged to conduct the process at higher temperatures, and the remaining oil left in the still is darker in color than when superheated steam is used in combination with the fire-heat.

From the above it will be obvious that my invention consists in producing heavy hydrocarbon-oils, suitable for lubricating and other purposes, and free from the characteristic odors of heavy hydrocarbon-oils, *from heavy hydrocarbon-oils*, by distilling from them the volatile matters from which the objectionable odors arise, and, at the same time, preventing new formations of such matters, by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil.

It will also be evident to those skilled in the art that my invention will be used, if the above-mentioned process be worked, to produce the deodorized heavy oils, above described, from distilled hydrocarbon-oils, from which the lighter burning oils and naphthas have not been separated, so long as they contain heavy oils, because the naphtha and lighter oils will go over first, leaving the heavy oil in the still to be operated upon; and also because, as before stated, the distilled heavy oils always contain more or less of the lighter bodies, owing to the breaking up of a portion of the heavy crude oil in the process of distillation.

I claim—

13 The above-described new manufacture of deodorized heavy hydrocarbon-oils, suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon-oils, and having a slight smell like fatty oil, from heavy hydrocarbon-oils, by treating them substantially as hereinbefore described.

Also, in combination with a still suitable for distilling oils, the superheating-coil, with its steam-pipe, outlet-pipe, and return-pipe, and their stop-cocks, arranged substantially as described.

JOSHUA MERRILL.

Witnesses:
CHAS. H. PLUMPTON.
MALCOLM C. GREENE.

TESTIMONY FOR COMPLAINANT.

Deposition of Benjamin Dickerman, taken before H. Farnam Smith, esq., special examiner, Tuesday, Oct. 25, 1870.

Direct examination, by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Benjamin Dickerman; age, forty-five; residence, Randolph, Mass. My business is that of an oil-broker.

Int. 2. Are you partner in the firm of Dickerman & Gregory, Commercial street?

Ans. Yes, sir.

Int. 3. State whether or not you are acquainted with an oil known in the market as Tweddle's topaz oil.

A. Yes; I am. I have seen it.

Int. 4. State whether or not you or your firm purchased of Messrs. Yeomans & Goss, at any time during the present year, any of that oil, or oil that purported to be of that make. If so, how much?

14 Ans. I did, on the fourteenth of February. I purchased one barrel.

Int. 5. Did you take a bill or receipt for the purchase?

Ans. I took a bill.

Int. 6. Please examine the bill now shown you, and marked "Exhibit No. 1, (complainant,)" and state whether that is the bill you took.

Ans. It is.

Exhibit No. 1, (complainant.)—H. Farnam Smith, special examiner.

BOSTON, *Feb'y* 14, 1870.

M Dickerman & Gregory bought of D. M. Yeomans & Goss, commission merchants and dealers in all kinds of burning and lubricating oils, 31 India street, Boston, and Parkersburg, W. Va.

David M. Yeomans. Daniel J. Goss.

1 bbl topaz oil, 46—2=44, @ 65 ..... 28 60

Paid Mch. 3.

77 85
28 60
———
49 25

D. M. YEOMANS & GOSS.
G. W. FROST.

☞ Terms cash. Bills payable at our office, or order.
☞ Claims for allowance to be made within 10 days.

[Two-cent stamp, cancelled.]

Received of Downer Kerosene Oil Co., twenty-eight 60 dollars.

SMITH & MERRILL.
M.

Int. 7. What do you do with that barrel of oil? If you sold it, state to whom.

Ans. I bought the oil from Messrs. Smith, Merrill & Co., and gave them an order for it.

Int. 8. Was the oil purchased at the request of Smith & Merrill?

Ans. It was.

Int. 9. Did you see the barrel yourself?

Ans. I did not.

Int. 10. What was the order you gave to Yeomans & Goss when you purchased it?

Ans. It was some time ago. I can't recollect the exact words. I usually write an order: "Please deliver the bearer one barrel" of whatever the kind of oil was (in this case topaz oil) "like sample."

15 Int. 11. Had you a sample, from which you made the purchase; and, if so, from whom did you obtain it?

Ans. I did have a sample, and obtained it from Messrs. Yeomans & Goss—I am not certain from which one of the two—and I showed it to Messrs. Smith & Merrill.

Int. 12. What was the character of that sample?

Ans. It was a neutral oil.

Int. 13. What do you mean by the term "neutral?"

Ans. Without odor, and hard to distinguish what class of oil it belongs to, by taste.

Int. 14. What was the color of it?

Ans. Quite a light color—a light yellow—hardly as light as a straw-color.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. What did you do with the sample by which you bought the oil mentioned in Exhibit No. 1 of the complainant?

Ans. Gave it to Messrs. Smith & Merrill.

Cross-int. 2. How long before buying the oil did you obtain the sample?

Ans. Either that day or the day before; I can't say which.

Cross-int. 3. Did you show the sample to Smith & Merrill before buying the oil?

Ans. I did; and they bought by it.

Cross-int. 4. Do you remember from what person you got that sample?

Ans. I do not. It was either Mr. Yeomans or Mr. Goss.

Cross-int. 5. How do you know that?

Ans. I knew both of them personally, and had a conversation with them. I think both were present.

Cross-int. 6. Whom did you see when you went to buy the barrel of oil? To whom did you give the order for it?

Ans. After getting the sample from Messrs. Yeomans & Goss, I carried it to Messrs. Smith & Merrill, and they said they would like one barrel to try it. I returned to Messrs. Yeomans & Goss; which was present, I cannot say. I reported that I had sold one barrel for trial. I gave an order to Messrs. Smith & Merrill.

16 Cross-int. 7. Do you mean, then, that you delivered the order in favor of Smith & Merrill to either Mr. Yeomans or Mr. Goss, you don't remember which?

Ans. No, sir; I reported the sale, that I had sold one barrel, and then I gave the order to give the teamster to get it.

Cross-int. 8. Do you remember to whom you reported the sale; whether to Mr. Yeomans or to Mr. Goss?

Ans. I can't say which was present at the time; in my opinion both were present.

Cross-int. 9. About the order for the teamster, do you remember to whom you gave that?

Ans. I think I gave it to Messrs. Smith & Merrill. It might be possible that I gave it to the teamster myself, but I think not.

Cross-int. 10. Have you made any other purchases of oil of Yeomans & Goss during the present year?

Ans. I have. I have sold to them and bought of them a great many times.

Cross-int. 11. Was that the topaz oil?

Ans. No, sir. The purchase shown by Exhibit No. 1 was my only transaction with them in topaz oil during the present year.

Cross-int. 12. You did not pay for the oil bought by Exhibit No. 1, did you?

Ans. I did. Smith & Merrill gave me the money, and I paid it.

Cross-int. 13. The Mr. Merrill you have spoken of is Mr. Joshua Merrill, of Boston, the plaintiff in this suit, is it?

Ans. No, sir.

Cross-int. 14. What Mr. Merrill is he?

Ans. The Mr. Merrill is a partner of Mr. Smith. I don't know what his Christian name is.

BENJAMIN DICKERMAN.

17. *Deposition of Caleb A. Smith, taken before H. Farnam Smith, esq., special examiner, Tuesday, Oct. 25, 1870.*

Direct examination by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Caleb A. Smith; 54 years of age; residence, Salem, Mass.; I am an oil dealer.

Int. 2. How long and where have you been engaged in that business, and how extensively?

Ans. For the past thirty years, in Salem and in Boston. Formerly in manufacturing very largely, and latterly only in buying and selling. I have been doing quite an extensive business.

Int. 3. Whether or not you purchased in February last, through Messrs. Dickerman and Gregory, a barrel of topaz oil, from Messrs. Yeomans & Goss?

Ans. We did.

Int. 4. How was the barrel marked, as nearly as you recollect?

Ans. All I remember, it had "Tweddle's topaz oil, Pittsburg."

Int. 5. Did you see the oil contained in it, yourself?

Ans. I did.

Int. 6. What was its character?

Ans. It was a neutral oil, sweet, and light colored.

Int. 7. What disposition did you make of that barrel of oil?

Ans. We sold it to the Downer Kerosene Co.

Int. 8. How long did you have it in your possession, and where did you keep it?

Ans. A few days, at our store.

Int. 9. Did you give any receipt to the Downer Kerosene Oil Company when you sold it?

Ans. I think our book-keeper did.

Int. 10. Please examine the writing on the end of Exhibit 1, and state whether that is written by your book-keeper.

Ans. It is.

Int. 11. Did the Downer Kerosene Oil Company take it away from your shop after the sale; if so, how soon?

18 Ans. Their teamster did; that day.

Int. 12. Since you have been a dealer in lubricating oils, for what purposes and to what class of persons have you been in the habit of making sales of that article?

Ans. For use in cotton and woollen mills, and to many other customers who required lubricating oils.

Int. 13. How long, and how extensively, have you dealt in the different kind of paraffine oils?

Ans. For ten or twelve years. We did a large wholesale business.

Int. 14. What is the general character of article which your customers desired to obtain, as a lubricating oil for use in cotton and woollen factories?

Ans. An odorless oil, with qualities similar to sperm oil; for lubricating.

Int. 15. Whether or not, prior to the spring of last year, you had complaints frequently from purchasers, in regard to the offensiveness of odor, and want of proper body, in the paraffine oils then in the market?

Ans. We had.

Int. 16. How frequent were such complaints?

Ans. It was a general objection to the use of paraffine oils.

Int. 17. Whether or not since that date there has been an article in the market, in which you have dealt, and which has been free from those objections; if so, what is it?

Ans. It is Merrill's lubricating paraffine oil. We get it from the Downer Kerosene Oil Company.

Int. 18. How extensively have you dealt in that oil; and for how long?

Ans. We commenced using it in March, 1868, and the last year we sold some eighty thousand gallons of it. We had the first barrel, I think, March 17, 1868.

Int. 19. Was that the first of that kind of oil you ever saw?

Ans. Yes, sir.

Int. 20. Prior to that date, was there any oil in the market resembling it in body, color, and freedom from odor?

Ans. I never saw any.

19 Int. 21. You considered it then a new article, did you?

Ans. Yes, sir.

Int. 22. Whether the demand for this oil has been an increasing one, since you began to sell it, down to the present time?

Ans. There has been a steady increase of sales.

Int. 23. Have you ever bought or sold any other than the single barrel testified about, of Tweddle's topaz oil?

Ans. No, we have not.

Int. 24. How did that barrel of oil compare, in general appearance and character, with Merrill's oil?

Ans. Very similar—a little lighter body, we thought.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. Did you purchase the barrel of oil from Yeomans & Goss last February, at the request of the Downer Kerosene Company?

Ans. No, sir.

Cross-int. 2. Did you buy it for the purpose of reselling it to them?

Ans. We bought it, as we make our purchase almost every day of Mr. Dickerman, from samples, to see what it was.

Cross int. 3. Did you buy it by the sample for the purpose of re-selling it to the Downer Kerosene Company?

Ans. We bought it as we do other paraffine oils, to examine and to sell to any one.

Cross-int. 4. Did you open this barrel of oil before it was sold to the Downer Company?

Ans. I did, and showed it to my brother, who was a manufacturer, and to one or two others, who were there, and who examined it at the same time.

Cross-int. 5. How did the Downer Kerosene Company know that you had it?

Ans. Mr. Merrill came in, I think, while we were looking at it—Mr. Joshua Merrill. He came in very frequently.

Cross-int. 6. Is there any business connection between your firm of Smith & Merrill and the Downer Kerosene Company?

Ans. Not any; excepting that we buy of them, as we would of others, wherever we can get the best trade.

Cross int. 7. Is Mr. Joshua Merrill a brother of your partner?

Ans. He is.

Cross-int. 8. How were the words "Tweddle's topaz oil, Pittsburg," marked upon the barrel of oil, which you bought in February last, of Yeomans & Goss?

Ans. I only remember looking, from some one's saying the name was Twedwells. We had a dispute as to whether it was Twedwell or Tweddle, and I remember looking to see how it was; but the particular mark I cannot describe further than that.

Cross-int. 9. Was the mark which you saw put directly upon the wood, or upon a label; and what kind of a label, whether pasteboard or metal?

Ans. My impression is that it was a stencil mark, but whether on the wood, or on a label, I don't remember. On the head of the barrel, I think it was.

Cross-int. 10. You say the oil in this barrel was neutral, sweet and light colored. What do you mean by neutral?

Ans. Little or no smell to it.

Cross-int. 11. What was the character of the little smell it had?

Ans. Slightly of paraffine.

Cross-int. 12. What do you mean by sweet?

Ans. We tasted it, and the taste was sweet.

Cross-int. 13. Do you mean that it had a sugarish taste; or do you mean that it was free from offensive taste?

Ans. Sweet for a paraffine oil.

Cross-*ans.* 14. How did it taste? What did it taste of, if anything?

Ans. It was nearly tasteless.

Cross-int. 15. What was the character of the little flavor that it had?

Ans. A paraffine flavor.

Cross-int. 16. How did it compare in color with the Merrill lubricating oil, which you began to sell in March, 1868, and have sold since?

Ans. Very similar.

Cross-int. 17. Did you ever observe in the Merrill oil what is called fluorescence, or a bluish appearance?

Ans. Much less than in any other paraffine oil that we ever used.

21 Cross-int. 18. Still you have observed it to some extent?

Ans. Without heating, we thought it was colorless, or nearly so. I mean, so far as the blue tint is concerned.

Cross-int. 19. If I understand you, heating the Merrill lubricating oil brings out this slight bluish appearance, or fluorescence. Is that so?

Ans. We combine it with other oils for a lubricator, and in warming the oil together, they have a slight color—bluish color.

Cross-int. 20. With what other oils do you combine the Merrill oil for a lubricator?

Ans. With sperm, lard, and tallow, and blackfish oils.

Cross-int. 21. Do you so combine it before you sell it?

Ans. We sell it for what it is, or what our customers require; a sperm lubricator, or a tallow lubricator.

Cross-int. 22. Do you sell it combined with the other oils you have mentioned, or do you sell it by itself, leaving your customers to combine it with the other oils?

Ans. We sell it combined, or by itself, as our customers require; either, or both ways.

Cross-int. 23. As a general thing is it combined with such other oils, either by you or your customers, before it is put to use for lubricating?

Ans. Some parties prefer it simple. For spindle use, a good many mills use it in that way. It depends on the judgment of the agent of the mills, in a great measure, whether they will have it combined or simple.

Cross-int. 24. Can you tell us, generally, under what circumstances it is customary to use it combined?

Ans. For heavy machinery combined, or where they have been in the habit of using heavy, fatty oils. Many are prejudiced against using a thin-bodied oil. We have never had any fault found with it, where they have run it simply for cotton-mills.

Cross-int. 25. Please give us a little closer description of what you call the paraffine oils, which were in the market for lubricating purposes, prior to the spring of last year. What do you mean by paraffine oils, in this connection?

Ans. An oil manufactured from the residuum, dark-colored, and with a strong, pungent smell, varying much in the quality.

22 Cross-int. 26. Was the Merrill lubricating oil made by purifying, or deodorizing, the oils you just described?

Ans. I don't know their process. I am not acquainted with their manufacture.

Cross-int. 27. Describe a little more clearly what you mean by pungent smell. Do you mean a rancid or rotten smell?

Ans. I mean a smell that the cotton manufacturers complained of for use in their mills, as being offensive to the operative.

Cross-int. 28. What was this smell like?

Ans. Similar to a crude petroleum smell.

Cross-int. 29. Was it the same smell as that, or was it a smell of rancid or decomposed paraffine?

Ans. I suppose it was a combination of the acid and petroleum together, that was never removed; that was peculiar to any of the petroleum products.

Cross-int. 30. You say that prior to March, 1868, you never saw any oil in the market resembling the Merrill oil in body, color, and freedom from odor. Had you ever seen any lubricating paraffine oil of the manufacture of Seccomb, Kehoe & Thayer?

Ans. Yes, sir. We furnished Seccomb with the first residuum, from which he manufactured his paraffine oil.

Cross-int. 31. When was that?

Ans. I think in 1862.

Cross-int. 32. What was the residuum that you so furnished?

Ans. It was the leavings of the petroleum stills.

Cross-int. 33. Was it tar?

Ans. We bought it for residuum. It is sometimes called tar. The usual name is residuum.

Cross-int. 34. Was it in fact a tar, or was it coke, or was it oil?

Ans. It was fluid, the thick bottoms that run off from the petroleum stills.

Cross-int. 35. Did you see any of the lubricating paraffine oil which Seccomb, Kehoe, & Thayer made in 1862, or within five years afterwards?

Ans. Yes, I have seen it.

Cross-int. 36. What was its character?

Ans. Average character of paraffines.

23 Cross-int. 37. Did it have a bad odor?

Ans. It had the same odor of the other paraffines that were in the market.

Cross-int. 38. You mean the offensive, pungent odor that you referred to?

Ans. I do.

Cross-int. 39. Was this lubricating paraffine oil of theirs on sale in the market, at the time that you saw it?

Ans. First we had samples sent us from the products of the residuum that we furnished. This was the first that I saw. Afterwards I don't know whether it was offered for sale or not, but I was shown samples.

Cross-int. 40. You never saw any lubricating paraffine oil of Seccomb, Kehoe & Thayer's make which was free from the offensive, pungent odor you have mentioned, did you?

Ans. No, sir; I never saw any that was odorless.

Cross-int. 41. You have spoken of a certain offensive, pungent odor which characterized the lubricating paraffine oils that were in the market before Merrill's, from which odor you say that Merrill's is free. Did you never see any lubricating paraffine oil of Seccomb, Kehoe & Thayer's make, that was free from that offensive, pungent odor?

Ans. I never saw any that was odorless.

Cross-int. 42. What do you mean by odorless?

Ans. That was free from this paraffine smell.

Cross-int. 43. Did you never see any of their make that was free from the offensive, pungent odor which you say characterized the lubricating paraffine oils that were in the market before Merrill's, and from which you say that Merrill's is free?

Ans. I never did.

Direct examination resumed:

Int. 25. You have spoken of compounding Merrill's oil with other oils. When this is done, does the mixture partake of the character of the paraffine, or of the other oils with which the paraffine oil has been mixed?

Ans. Of the fatty oils, that it is combined with.

24 Int. 26. Suppose the mixture is in the proportion of three parts of Merrill's oil to one part of fatty oil, is the mixture characterized by the smell and appearance of paraffine oil, or of fatty oil?

Ans. Of fatty oil entirely.

Int. 27. Is there any smell of paraffine oil about it?

Ans. Not at all.

Int. 28. Is this what you mean by the term neutral, which you apply to this oil?

Ans. Yes.

Int. 29. Prior to Merrill's, did you ever see any other paraffine oil which would combine with other oils, and partake of their character so as to give no odor to the oils with which it was mixed?

Ans. I never did.

Int. 30. Had there been such an article, was your business such that you would have known it necessarily?

(Objected to, for form, and as opening new matter.)

Ans. Yes, we were offered samples of nearly all manufacturers—of different manufacturers, daily.

Cross-examination resumed, de bene:

Cross-int. 44. Did you ever try any experiment of mixing any samples of Seccomb, Kehoe & Thayer's lubricating paraffine oil with other oils, to see whether it was neutral, before the time of Merrill's oil?

Ans. No, I never did.

CALEB A. SMITH.

Deposition of Lucien B. Squier, taken before H. Farnam Smith, esq., special examiner, Wednesday, Oct. 26, 1870.

Direct examination by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Lucius B. Squier; forty-one years of age; I reside in Brooklyn, N. Y. I am an oil merchant.

25 Int. 2. How long have you been engaged in that business, and how extensive has your business been?

Ans. I have been engaged in the business since 1857; have done a business of say $200,000 a year.

Int. 3. Whether or not you are familiar with what are known in the market as paraffine oils, and if so, for how long a time have you dealt in them?

Ans. I am. Have dealt in them nearly the whole time that they have been in the market.

Int. 4. For what purposes, and to what class of persons, have your sales of paraffine oils been made?

Ans. Most entirely to manufacturers, for lubricating purposes.

Int. 5. What are the general characteristics of the oil which such purchasers desire to obtain?

Ans. An oil that is a good lubricator, free from smell, and free from acid.

Int. 6. Whether or not you have been in the habit in your business of mixing or compounding paraffine with other oils, for the purposes of your trade?

Ans. I have.

Int. 7. Are you acquainted with the paraffine oil known as Merrill's lubricating oil? If so, how long have you known it, and how extensively have you dealt in it, if at all?

Ans. Yes, sir. We have known it since February, '69, and since then have sold about 20,000 gallons.

Int. 8. Prior to February, 1869, had you, in your business, sold paraffine oil unmixed with any other oil, as a lubricator, or not?

Ans. We had in a few instances sold it with other oils, to be mixed

by the purchaser. I think only in two or three instances. I mean to two or three customers.

Int. 9. Whether or not complaints were made by your customers, prior to that date, in regard to oils purchased from you for lubricating purposes, which were composed of paraffine and other oils combined; and, if so, what was the nature of those complaints?

Ans. We had complaints. The principal cause was from staining goods wherever the oil would touch them, and the other cause from the strong odor.

26 Int. 10. If a combination was made of paraffine oils, such as you dealt in prior to 1869, and fatty oils, did the compound partake of the character, color, and odor of the paraffine or of the fatty oils?

Ans. Of the paraffine oil. In regard to the color, we used so little of the paraffine oil that it did not affect the color much, excepting the blue tinge arising from the paraffine.

Int. 11. About what proportion of the paraffine oil you had dealt in prior to Merrill's oil, could you mix with fatty oils, without imparting the characteristics of paraffine oil to the compound?

Ans. Not any. A very small quantity of the paraffine oil would impart its characteristics to the other oil. What I mean by not any, is, in comparison; we used to use from two to five gallons to a barrel of, say, from forty to forty-five gallons of other oil. Very rarely more than that.

Int. 12. Since you have dealt in Merrill's oil, have you been in the habit of selling any, and, if any, how much, for lubricating, in a pure form and unmixed with fatty oils?

Ans. We have. How much I can't say; perhaps from thirty to thirty-three per cent.; perhaps one-third of it.

Int. 13. Do you know for what class of machinery this was used?

Ans. For cotton spindles mostly.

Int. 14. What proportion of Merrill's oil can you mix with fatty oils, without imparting the odor and appearance of paraffine oil to the compound?

Ans. You can use seventy-five to eighty per cent. without any odor from it; but you will get a little of the blue tinge from any paraffine oil.

Int. 15. Since you have sold lubricating oil, composed of Merrill's deodorized oil and fatty oils combined together, have you received the same complaints with regard to the staining of the goods and offensiveness of odor, or not?

Ans. We have received no complaints of it.

Int. 16. Whether or not you have had complaints from purchasers who purchased Merrill's oil for use, uncombined with any other oil?

Ans. No.

Int. 17. Prior to February, 1869, did you ever see any paraffine oil that resembled Merrill's in freedom from odor, and in its oleaginous properties?

27 Ans. We never did.

Int. 18. How does Merrill's oil compare in fluorescence with the common paraffine oils you had known in the market before you saw his?

Ans. What do you mean by fluorescence?

Int. 19. I mean the tendency to decompose the rays of light, so as to give it a blue or green tinge.

Ans. It is much more free from that color than any other paraffine we ever saw. The paraffine that we were using before had more of a bluish

tinge. This had more of a greenish one; but not to anything like the same extent. The color itself was very much lighter than anything we had ever seen up to that time.

Int. 20. Whether or not it was, in your judgment, a new article in its characteristics and properties and in the uses to which its properties enabled it to be put?

(Objected to as leading and incompetent.)

Ans. We considered it entirely a new article.

Int. 21. Whether or not you were in the habit in your business of examining and purchasing all desirable kinds of paraffine oil of which you became aware in the course of your trade?

Ans. We always examined what there was in the market, and bought the best—what we considered the best.

Int. 22. How did the price of the common paraffine oils you were in the habit of purchasing before you bought Merrill's compare with that in price?

Ans. From twenty to fifty per cent. less, according to quality. Different makers made different grades.

Int. 23. In mixing Merrill's oils with fatty oils to make such a lubricating oil as is desired by your customers, what proportion of fatty oils do you use with Merrill's oil ordinarily?

Ans. From fifteen to twenty-five per cent.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. What do yon understand by the term paraffine oils, as applied to such oils as you have sold for lubricating purposes in time past?

Ans. I don't know as I can give a scientific definition of the term. It is the product of petroleum, and distilled from the residuum.

28 Cross-int. 2. Can you describe the strong odor which you say was objectionable in these paraffine oils?

Ans. I don't know that I can, so as to be understood. It was a very pungent odor, something very difficult to be overcome.

Cross-int. 3. That describes its strength rather than its character, perhaps. Can you give an idea of its character?

Ans. I don't know as I can. It was different from anything else. It has the petroleum smell, only very strongly.

Cross-int 4. What is the acid which you speak of as in these paraffine oils?

Ans. The acid used in distillation. I don't know what acid they do use. I suppose that is it.

Cross-int. 5. Do you know whether this acid had anything to do with the offensive smell, or was it objected to on other accounts than that of the smell?

Ans. I don't think the acid had anything to do with the smell. It was objected to on account of staining the goods, and also, in two instances, on account of corroding the machinery.

Cross-int. 6. Where did you get your paraffine oil?

Ans. Mostly in New York.

Cross-int 7. Will you name the principal wholesalers of whom you bought it?

Ans. I can't remember them all now. Libby and Clark was one of the principal ones. Richardson (I think, John R.) was another; he had his office with Woodruff and Houston. Charles Flanders. We bought considerable from the West—I don't recollect the parties now. These purchases from the West were made principally through brokers.

Cross-int. 8. You say that you can use seventy-five to eighty per cent. of Merrill's oil mixed with fatty oils without any odor from it. Is there any odor to Merrill's oil, by itself?

Ans. A very little indeed. None of that strong pungent odor that there was in the oils which we used to use. No more than there would be to any oil—than there would be to whale or sperm oil.

Cross-int. 9. Is the smell that there is in Merrill's oil a paraffine smell?

Ans. Yes.

29 Cross-int. 10. Is it the same sort of smell as was in the paraffine oils you previously sold for lubricating purposes, only not as strong or pungent?

Ans. There is nothing pungent about the smell of this oil at all.

Cross-int. 11. What do you mean by a pungent smell as distinguished from a strong smell?

Ans. I mean by a pungent smell a rank smell.

Cross-int. 12. What do you mean by a rank smell as distinguished from a strong smell?

Ans. I suppose either one covers it.

Cross-int. 13. Is not the smell of Merrill's oil really the same sort of smell as that of the lubricating paraffine oils which you previously sold, only less in amount?

Ans. No, it is not; there is nothing volatile in it. Now I come back to it, I think the acid must have something to do with the smell. I think so for the reason that Merrill's oil has a different smell—a sweeter smell.

Cross-int. 14. They both smell of paraffine, do they not?

Ans. I should say not.

Cross-int. 15. Did the paraffine lubricating oil you sold before Merrill's have a paraffine smell?

Ans. I am not conversant enough with the manufacture of paraffine to tell what gives it that smell, whether it is the acid or not. Whenever we get that smell we say it is paraffine right off. Paraffine wax itself has a sweet smell; Merrill's oil has a similar smell; while the ordinary paraffine oil which we used to use had a very strong, offensive smell.

Direct examination resumed:

Int. 24. Whether or not you have had any training or experience as a chemist, or been engaged in any way in the manufacture of paraffine oils?

Ans. Neither one.

LUCIEN B. SQUIER.

30 *Deposition of Nathaniel O. Parks, taken before H. Farnam Smith, esq., special examiner, Wednesday, Oct. 26, 1870.*

Direct examination by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Nathaniel O. Parks; forty-one years of age; reside in Brooklyn, N. Y. I am an oil-dealer.

Int. 2. How long and to what extent have you been engaged in that business, and what class of oils have you dealt in since you have been so engaged?

Ans. Since 1850; to some considerable extent. Have dealt in heavy burning and lubricating oils for steamship and railroad uses.

Int. 3. Whether or not you are familiar with what is known in the market as paraffine oils, and, if so, how long have you dealt in them?

Ans. I know the oils, and have dealt in them some seven or eight years.

Int. 4. What are the general characteristics of the oil which your purchasers have sought for for lubricating use?

Ans. A heavy lubricator, with a light oil; that is what the demand is for generally. I mean light in color.

Int. 5. Whether or not the odor of the oil is material in your trade?

Ans. To a great extent.

Int. 6. Do you or not in your business mix paraffine with other oils to form lubricating oil?

Ans. Yes, sir.

Int. 7. Are you acquainted with the paraffine oil known as Merrill's lubricating oil? If so, how long have you known it, and how extensively have you dealt in it?

Ans. Yes, sir. Have known it since 1868, and have dealt in it very extensively.

Int. 8. Do you in your trade sell any paraffine oil for lubricating purposes unmixed with other oils or not?

Ans. Not outside of the Merrill oil.

Int. 9. Prior to dealing in the Merrill oil had you in your trade sold any paraffine oil unmixed for lubricating purposes?

31 Ans. Not as a general thing. There might be some few instances as an exception.

Int. 10. Whether or not, prior to that period, complaints were made by your customers in regard to the lubricating oils purchased from you, and composed of paraffine and fatty oils combined? And if so, state what those complaints were.

Ans. We have had some more or less complaints. The complaints have been, more or less, in regard to color and lightness of body. Some few complaints of the smell of oil. We never allow more than one complaint to be made. We always remedy when we hear the first complaint.

Int. 11. Since you have sold Merrill's oil in combination with the fatty oils, for these purposes, have you, or not, received similar complaints?

Ans. I can't say that we have heard the first serious complaint.

Int. 12. In what proportions do you usually, in your trade, combine Merrill's oil with the fatty oils, and what is the character of the combination as to body, odor, and color?

Ans. We use from thirty to sixty-five per cent. of the Merrill oil in manipulating our different qualities of oil, and in a great many instances we send it out as it is—natural—in about a quarter of our trade. The character of the combination is in every way satisfactory.

Int. 13. How does the combination compare in these respects with the fatty oils used in making that combination?

Ans. We think a man must be an expert to detect it from the fatty oil itself. No ordinary man using it can distinguish it from the natural oils, when we use thirty per cent. of it.

Int. 14. In what proportion did you, in your business, mix the common paraffine oils you used before using Merrill's oil, and what was the character of the compound formed thereby?

Ans. We never used over twenty-five per cent. and usually about ten per cent. of the old paraffine oils, and then we would make an inferior oil. I never considered the oil had much of a character.

Int. 15. How was that compound as to odor?

Ans. Rather repulsive than otherwise.

Int. 16. Prior to the date when you began to deal in Merrill's oil, had you ever seen in the market any oil that resembled it as to color, body, and odor?

32 Ans. Never, sir.

Int. 17. Were you, or not, in the habit, in your business, of examining and purchasing all paraffine oils offered in the market?

Ans. Invariably. If we heard of a paraffine oil, we would get a sample of it and try it, to see if it had any worth in it or not.

Int. 18. Since you have known Merrill's oil have you ever seen any other oil that resembled it, as to color and odor?

Ans. I never have.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. Do you sell fatty oils, alone, for lubrication?

Ans. Yes, sir.

Cross-int. 2. Are they entirely satisfactory as lubricating oils?

Ans. Not in every instance.

Cross-int. 3. What are the objections?

Ans. The objections to the fatty oils, outside of sperm itself, are its glutinous matter commonly termed gum.

Cross-int. 4. You said that when you had complaints you always remedied the difficulty at once. How about the few complaints which you had of the smell of the paraffine oils for lubricating, formerly sold by you? How did you remedy that?

Ans. The only remedy we had was to stop using it, that was all; which we have done in a number of instances.

Cross-int. 5. Will you name the principal wholesalers from whom you have bought lubricating paraffine oils, before you bought Merrill's?

Ans. Warehouse & Merriam, Cleveland, through their agent, Philo Parsons, in Maiden Lane, New York; Libby & Clark; Charles Flanders; Long Island Kerosene Oil Co., through their agent, Richardson; New York Warehouse Co., agent for some of the concerns. That is about all; we bought more or less of brokers.

N. O. PARKS.

33 *Deposition of William Atwood, taken before H. Farnam Smith, esq., special examiner, Thursday, Oct. 27, 1870.*

Direct examination by Chauncy Smith, esq., in behalf of the complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. William Atwood; forty years of age; I reside at Cape Elizabeth, Maine; I am a manufacturing chemist.

Int. 2. What special branch of manufactures are you engaged in?

Ans. The manufacture of oils, known as hydrocarbons, and acids, and other chemicals.

Int. 3. How long have you been concerned in the manufacture of hydrocarbon oils?

Ans. To a greater or less extent, since the winter of 1851 and '52.

Int. 5. Are you now connected with other parties in the manufacture of those oils? If so, state the name of your company, and give your place of business.

Ans. I am now employed as superintendent and chemist by the Portland Kerosene Oil Company. Their business office is in Portland; their works in the adjoining town of Cape Elizabeth.

Int. 5. Where did you first become acquainted with the manufacture of hydrocarbon oils?

Ans. In Boston.

Int. 6. Will you state what the character of the manufacture was at that time; who the parties were; who were engaged in it?

Ans. My first information was purely of an experimental kind. Th character of the oils at that time was very offensive in odor. The first parties who manufactured on a commercial scale were the United States Chemical Manufacturing Company, located at Waltham, Mass.

Int. 7. Do you mean that these were the first parties that you were acquainted with who were engaged in that manufacture, or the first, so far as you know, who were engaged in the business in this country?

Ans. The first, so far as I know, who were engaged in the business in this country.

Int. 8. When did that company first engage in the business?

34 Ans. That company was organized in 1853. The works were erected by parties previously to that, but they cannot be said to have been engaged in the business, as they did not put any oil into the market.

Int. 9. What connection did you have with that company or with the parties who erected the works, and when did your connection commence with them?

Ans. I was employed as assistant to my brother, who was the chemist and superintendent. My connection commenced with him in 1850. The first experiments were undertaken, that led to the investigation of those oils, in the winter of 1850 and '51.

Int. 10. Upon what material were those experiments made, and what was the character of the process which you applied to it, and what results did you obtain?

Ans. The material was coal tar from the gas-works. The character of the process was the distillation of coal-tar and the purification of the different distillates. We obtained lubricating oil from the more fixed and heavy distillates, the oil having a disagreeable odor, and not having sufficient body to be used as a lubricator alone, but having powerful antiseptic qualities, which made it valuable for mixing with other oils having a tendency to gum or oxidize; making a good lubricating oil of the mixture, with the exception of its odor. We obtained, also, benzole and naphthas.

Int. 11. When the company of which you have spoken commenced to manufacture for commercial purposes, what was the product which they designed to produce as the leading object of their manufacture?

Ans. This lubricating oil known as coup oil.

Int. 12. When was this oil first put upon the market by that company?

Ans. In the winter of 1853 and '54. I am not certain whether it was in December, or not until January.

Int. 13. For what purposes was it put upon the market? What class of customers was looked to for using it?

Ans. Mixed with other oils, it was put upon the market as a lubricating oil. All manufacturers using machinery of any kind, and railroads and steamboats, were looked to as customers.

Int. 14. What kind of oils was it mixed with?

35 Ans. It was mixed with whale oil, lard oil, castor oil, and small quantities with other fatty oils.

Int. 15. Was it used to any extent alone as a lubricator?

Ans. It was not used at all alone, to my knowledge.

Int. 15. Why not?

Ans. It lacked body, and would not remain upon the bearings, but ran off.

Int. 17. So far as you know, had any oil of this kind, that is, oil distilled from coal tar or other hydrocarbon bodies, been in use in this country before the company you have spoken of put this oil upon the market?

Ans. It had not.

Int. 18. How was this oil received by the consumers? How fast did it make its way into use?

Ans. It was received by the owners of mills with a great deal of favor, but opposed by their operatives. It was introduced rather slowly and with a great deal of labor, owing to its offensive odor.

Int. 19. Why was it received with favor by the mill-owners, and why was it opposed by the operatives?

Ans. It was received with favor by the mill-owners because it proved to be an excellent lubricator when mixed with other oils; and opposed by the operatives on account of its strong, pungent, persistent odor.

Int. 20. What was the expense of the mixed oil, as compared with the oils with which it was mixed? I do not now mean by the gallon, but the expense to the consumer for lubricating his machinery, in a given period of time.

Ans. The oils with which it was mixed were hardly used as lubricators. If you mean by your question, what was the expense of lubricating with this mixture, as compared with lubricating with other oils that were used as lubricators, I should say about one-half.

Int. 21. Were the oils with which your oil was mixed to form a lubricating oil cheaper per gallon than those oils which were suitable for lubrication, and which were in use at that time?

Ans. They were.

Int. 22. In what proportion did you generally mix your oil with the other oils?

36 Ans. Our oil usually made from about fifteen to thirty-three per cent. of the mixture.

Int. 23. What was the character of the odor of the mixed oil as compared with the coup oil itself?

Ans. Very little apparent difference.

Int. 24. Did you make any effort to remove that odor, in order to free your oil from the objection which the operatives made to it? If so, state what was the nature of the efforts you made, and how constant or persistent they were.

Ans. We did make efforts to remove the odor, applied all known chemical agents likely to destroy or modify the odor, as well as varied the modes of distillation; and were constantly searching for improved processes, and finally commenced experiments upon other substances as the source from which to make the oil.

Int. 25. While you were using coal tar as the source from which to procure oil, did your company produce any other products, either subsidiary products, of more or less commercial value, or waste products? If so, state what they were.

Ans. We did produce other products, some of commercial value, and others waste products—naphtha and benzole. We purified and sold all of these products that was to be obtained from the tar. Naphthaline and para-nap'thaline we obtained in considerable quantities, of which but very little was used. Coal-tar asphaltum or pitch we obtained in large quantities, which was finally all disposed of, either for fuel or other pur-

poses. Phenic acid we obtained in considerable quantities, of which but little was used. Large quantities of tarry matter were separated by the chemicals, of which no use was made. There were also large quantities of gas produced in distillation, of which no use was made.

Int. 26. You have spoken of your efforts to improve the character of this oil, as to its odor, by chemical means, and by improved methods of distillation. What success attended these efforts?

Ans. A considerable degree of success; so much as to almost change the character of the oil.

Int. 27. Did it change its character in any other respect than as to its odor?

Ans. Only in respect to its color.

37 Int. 28. As to its odor, did you succeed in changing it sufficiently to remove the objections which the operatives had made to its use? What was the extent of the change?

Ans. We did not. The extent of the change, however, was such as to be acknowledged even by its bitterest opponents.

Int. 29. Did you succeed in changing it sufficiently by these means to render any further efforts for its improvement in that direction unimportant, in your own judgment?

Ans. We exhausted the resources of chemistry without accomplishing it; that is, the resources, so far as anything was brought to our knowledge at that time.

Int. 30. In a previous answer you stated that in your efforts to overcome this objection you finally commenced experiments upon other substances as the source from which to make the oil. What were the substances upon which you made the experiments, and what came from the experiments?

Ans. We experimented upon bituminous coals, bituminous shales, asphaltums, and petroleums. Petroleums and bitumens from nearly all the known sources, and many different varieties of coals and shales. We succeeded in producing what we regarded at that time as a good lubricating oil from each of those different sources, having so much less odor than the coup oil that we considered we had no difficulty in introducing any one of them into the trade.

Int. 31. In the manufacture of the coup oil, did you obtain paraffine as one of the products, or can it be obtained from the coal tar which you used in making coup oil?

Ans. We did not obtain paraffine from any of the coal tar obtained in the States, neither can it be obtained from any that I ever examined from the States.

Int. 32. Did you substitute in your manufacture any of the articles on which you experimented in place of the coal tar? If so, state what it was.

Ans. We did. There were three of us connected with the establishment at Waltham. Within the next year after abandoning coal tar, each of us operated to a considerable extent with a different material. I went to the island of Trinidad for the purpose of manufacturing oil from pitch or asphaltum, obtained from what is known as the

38 Trinidad Pitch Lake. My brothers went to New York and commenced the manufacture of oil from the Breckenridge, Kentucky, coals, and other coals. Mr. Joshua Merrill went to South Boston to Mr. Downer's factory, and commenced operations there with Albert coal from New Brunswick, and small quantities of other coals.

Int. 33. When did the three parties you refer to separate and leave the establishment at Waltham?

Ans. During the winter of 1856 and '57. I left there myself in December, '56.

Int. 34. At that time had any other establishment in the country commenced the manufacture of hydrocarbon oils for purposes of lubrication?

Ans. They had attempted the manufacture. I can hardly say that they had succeeded in producing an article which they could sell.

Int. 35. You stated that you resorted to the other substances you have named, as a source from which to procure oil, for the purpose of obtaining an oil free from the offensive odor of the oil you made from coal tar. Will you state how the oil obtained from these new sources differed in respect to its odor, or in any other respect, from that made from the coal tar, and whether it was put into the market under the same name, and to be used for the same purposes?

Ans. Its odor was of a different character, less offensive, not affecting the eyes of the person going into a warm room where it was in use in the least, whereas some persons did complain of the coup oil affecting them in that way. The odor did not adhere to clothing so tenaciously as that of the coup-oil odor. It was very much more oily, so much so as to lead many to think that it might be used alone as a lubricator. It differed also in chemical composition, there being three classes of oils properly denominated hydrocarbon oils, of which coup oil was one, it containing the largest amount of carbon compared with the hydrogen. The coal oils, shale oils, and petroleum oils being another, containing the least amount of carbon in proportion to the hydrogen. The asphalt oils containing an intermediate quantity of carbon compared with the hydrogen. The second class of oils constituting those now known as paraffine oils. It was not put upon the market under the same name, but was put upon the market to be used for the same purposes.

39 Int. 36. When you speak of the oils obtained from the coals as being more oily than that which you obtained from coal-tar, do you refer to a difference in respect to what you mentioned as to the coal-tar oils, of a want of body?

Ans. Yes, sir.

Int. 37. Why are the oils obtained from coals, mentioned in your last answer, called paraffine oils?

Ans. Because they are always associated with paraffine.

Int. 38. Was not the coal tar which you used in the manufacture of your coup oil obtained from the gas-works as the residuum from the distillation in the manufacture of gas, from the same kind of coals which you afterwards resorted to for obtaining oils; and, if so, why did you obtain paraffine, and what you call paraffine oil, when you distilled those coals, while you obtained your coup oil, and no paraffine, from the tar derived from the same coal?

Ans. Yes, sir; the same coal from which we obtained oil was then, and is now, largely used in the manufacture of gas. The reason that we obtained paraffine and paraffine oil from our distillation of the coal, while by the distillation of the same coal at the gas-works they generated benzole, naphthaline, and para-naphthaline and other hydrocarbons, differing in chemical composition from those obtained by us, was that we used the lowest heat at which those coals could be distilled, while at the gas-works the temperature was maintained at a bright cherry-red heat, or even higher than that, they obtaining comparatively a large volume of gas, with a small quantity of liquid products, while at the temperature that we used a large quantity of liquid was formed, with comparatively a small quantity of gas; the liquids formed at low temper-

atures being different in chemical composition and physical properties from that obtained at high ones.

Int. 39. So far as you know, had the paraffine oils, as you have called them, been used commercially in this country at the time their manufacture was commenced by Messrs. Merrill & Downer, at South Boston, and your brother at New York, and yourself at Trinidad?

Ans. They had not.

Int. 40. Has the coup oil been manufactured and used for lubricating oil since that time?

Ans. Not to my knowledge.

40 Int. 41. What was the comparative expense of manufacturing them?

Ans. The paraffine oils were the cheapest to manufacture.

Int. 42. In a previous answer, in speaking of the paraffine oil, you said it was very much more oily than the coup oil; so much so as to lead many to think that it might be used alone as a lubricator. Did experience confirm this; and, if so, to what extent?

Ans. I hardly think I can say experience confirmed that; still, it has always been used by a few persons for special purposes alone as a lubricator. Not to a very great extent, however.

Int. 43. What are those special purposes or special cases?

Ans. Those having light, quick-running machinery, and small machine-shops; for oiling shafting. More particularly from the taste of the person having charge of them than for any other reason.

Int. 44. You have spoken of the different odor of this oil as compared with that of the coup oil. Did this difference prove to be such as to relieve the oil from the objections which were entertained as to the coup oil, in whole or in part, and to what extent, if in any degree?

Ans. The difference, I think, proved to be so great that in the same state of the market as that in which we introduced the coup oil there would have been no objection raised on account of odor; but when we introduced those oils known as paraffine oils, sperm oil, and the better class of oils for lubricating purposes, were very much cheaper, and manufacturers were not so anxious to find a substitute for them. Still the complaints were very much less, and the difficulties of introducing it very much less than the difficulty of introducing coup oil in the circumstances existing at the time that was introduced.

Int. 45. How was the new oil received by the operatives?

Ans. I do not recollect of hearing of any complaints.

Int. 46. When mixed with other oils like those with which the coup oil was mixed, in what proportion did you use it, and what was the character of the compound?

Ans. What I have had mixed under my own supervision, I have had mixed from fifty per cent. up to eighty per cent. of our oil. The character partook somewhat of the nature of both of the oils that entered into its composition, whenever neither one predominated to a very great extent in quantity.

41 Int. 47. What was the character of the odor of the compound, when mixed in nearly equal proportions, or even when seventy or eighty per cent. of your oil was used?

Ans. When mixed in nearly equal proportions, you could usually recognize the odor of the different oils that were mixed with it, as well as the odor of our oil. When mixed in the proportions of seventy-five per cent. and upwards, the odor of the fatty oil was completely covered up.

Int. 48. When you say your oil, do you refer to the oils which you

now or have of late years manufactured, or to those made when you first commenced the manufacture of paraffine oils?

Ans. More especially to those that I have made recently.

Int. 49. How have the oils which you have made recently compared in quality and in the price which they bore in the market with the lubricating oils produced by other manufacturers?

Ans. They have been considered among the best that were made, and have borne the highest prices; with the exception, perhaps, of that of Mr. Merrill's, which he is now manufacturing.

Int. 50. How much higher have your oils been above that of other manufacturers?

Ans. From ten to fifty per cent., perhaps. There are various grades of oil, some of which perhaps can hardly be said to be purified.

Int. 51. To go back to your own personal history in connection with the manufacture of these oils, how long did you remain in Trinidad, and where did you engage in business on leaving that place?

Ans. I was in Trinidad about eighteen months. On returning from there I was with Mr. Downer for eight or ten months, since which I have been at Portland.

Int. 52. Have you been concerned in the manufacture of lubricating oils ever since you went to Portland?

Ans. Yes, sir.

Int. 53. When was petroleum first resorted to as the source for obtaining paraffine oils, and when did its use become general with the manufacturers of this country?

Ans. I think it was first resorted to in commercial quantities in 1858. It became very general as a crude article from which to make
42 those oils in the fall of 1861 or winter of 1862. Still not exclusive until about 1866.

Int. 54. How did the lubricating oil obtained from petroleum, when its use became general, say in 1861 or 1862, compare with the lubricating oil which, up to that time, had been made from the different coals or from the Trinidad asphaltum?

Ans. When thoroughly and well purified, the lubricating oil obtained from petroleum and that obtained from the different coals was essentially alike. That obtained from Trinidad asphaltum did not contain any paraffine, or, if any, extremely small quantities. The amount of carbon in the asphaltum oil was greater when compared with the hydrogen than in the coal or petroleum oils.

Int. 55. When you say that the oils obtained from petroleum and from coals, when well purified, are essentially alike, do you include their odor and lubricating properties, as well as their chemical nature?

Ans. I do. Their odor, so far as their introduction into commerce is concerned, is essentially the same, but not so far alike as to prevent a person familiar with the different oils from distinguishing the difference in the source from which they are derived. With regard to their lubricating properties, if skilfully made they would be essentially alike. Their specific gravities would vary somewhat, without a corresponding variation in their oleaginous or viscid qualities.

Int. 56. So far as you know, have the lubricating oils obtained by different manufacturers from petroleum been used, unmixed, to any greater extent for lubricating than those derived from coal?

Ans. I think not, proportionally. There have been vastly larger quantities of lubricating oil used since it has been made from petroleum, but relatively I think the quantity is not larger than when it was made from coal.

Int. 57. When were the oils made from these sources first manufactured for illuminating purposes, and when did their manufacture become so general or important as to become the leading object of the manufacturers?

Ans. I think about 1856 ('55 or '56) they were first attempted to be introduced as burning oils. They became a leading article in 1857.

43 Int. 58. Will you state whether the manufacturers generally produce oils for both purposes, illumination and lubrication, and which purpose most manufacturers, during the last ten years, have regarded as the most important?

Ans. I think that a majority of the manufacturers have regarded the illuminating oil as almost an exclusive object of manufacture. Very few manufacturers have attempted to produce both kinds.

Int. 59. Will you give the names of those who have attempted to produce both kinds, and particularly of those who have given special attention to the production of the best quality of lubricating oils?

Ans. I do not think of any parties now doing business, excepting the Downer Kerosene Oil Company, including the Corry Branch in Pennsylvania, and the Portland Kerosene Oil Company, who have attempted to produce both kinds, and who make lubricating oil of first-class quality a specialty.

Int. 60. I believe that illuminating oil is produced by distillation of petroleum, as well as the lubricating oil. Will you state whether the amount of illuminating oil which can be obtained can be varied by the manner in which the distillation is conducted? and, if so, what are the conditions which insure the production of the largest amount of the illuminating oil?

Ans. It can be varied. It can all be made into illuminating oil, without any lubricating oil, or any paraffine, that is necessary to be removed from it. In order to produce the largest amount of illuminating oil, which is the total quantity of oil obtained, it is necessary to remove that part of the oil which already has the character of burning oil, by fractional distillation, until the point is reached at which the oil comes over of too great a specific gravity to be used as a burning oil, when the fires should be slackened and the distillation so regulated and conducted that all those oils having too great a specific gravity, and too high a boiling-point for illuminating oils, shall condense and fall back into the still, until by repeated redistillations their specific gravity and boiling-point shall be so changed, as well as the mobility of the oil, that the whole body can be used as a burning oil, and until the paraffine is so far changed into liquid hydrocarbons, having a lower boiling-point than that of paraffine, that what remains unchanged shall remain in solution in the oils at all ordinary temperatures.

44 Int. 61. Conversely, can you convert petroleum wholly into lubricating oil or paraffine?

Ans. No, sir; you cannot.

Int. 62. Is it not true, that the character of the products obtained by the distillation of petroleum, and the proportions which those products bear to each other, can be widely varied by varying the manner in which the distillation is conducted?

Ans. They can be very widely varied in their character and proportions.

Int. 63. You spoke of your own company at Portland as giving special attention to the manufacture of lubricating oils. How long has this been so?

Ans. I think I may say since the organization of the company in the spring of 1859.

Int. 64. In the early part of your deposition you spoke of the efforts you made to improve the coup oil as a lubricating oil, and the difference between that and the paraffine oil which you obtained from coals and petroleum. Will you now state whether you have, since the organization of your company in 1859, made any further efforts to improve your lubricating oil; and, if so, what the object of those efforts has been, what improvements you sought to make, and by what means you attempted to secure them, and with what results?

Ans. I have attempted since 1859, often, to improve the qualities of our lubricating oil. The two particular improvements that I have sought to effect have been the removal of the oils known to be associated with it, and of themselves too thin for lubricating oils, and also to so far improve the lubricating oil in its oleaginous or viscid qualities as to fit it to be used exclusively, without any mixture of other oils. The methods by which I have endeavored to effect this have been by modified modes of distillation, consisting of practical condensation, by which I mean condensing those portions of the vapor which condense the easiest, separate from the other portions. I have some experiments, not finished, by which I endeavored to remove the volatile oils by distillation without distilling the heavy or lubricating oils. In regard to the results, I have very much improved the quality of our own oil at the expense of the quantity made, preferring to put a strictly first-class article into the market in moderate quantities, rather than larger quantities of an inferior quality.

Int. 65. Will you state whether these efforts to improve your oil have extended over the whole period since 1859, and when the improved character was given to your oil that you speak of in your last answer?

Ans. They have at intervals; not one continued series of experiments. It has always been in view to improve the lubricating qualities of our oils as chance offered. The improvement has been made from time to time during the whole period; very little improvement, perhaps, having been made within the last year and a half.

Int. 66. What effect did the volatile oil that you speak of attempting to remove have upon the character of the lubricating oil?

Ans. Those volatile oils being of a thin, spirituous nature, they imparted somewhat of their character to the oils with which they were mixed, and also, being volatile, are more likely to evaporate and to diffuse their own peculiar odor through the room where they are used.

Int. 67. During this period since 1859 how much have you known of the lubricating oil manufactured by the Downer Kerosine Oil Company of South Boston, and of their methods of manufacture, and how has their lubricating oil compared in quality with that produced by your company or by other manufacturers?

Ans. The first few years of that time we were in constant communication, constantly visiting each other's works, and may be said to have been familiar with each other's operations. Since then we have visited less frequently, and I have not been so familiar with what they have been doing at their works at Boston. Although I think scarcely a year has gone by but what we have met and had some consultation with regard to the different oils made from petroleum until within the last two years. I think during a greater portion of the time their oil stood side by side with ours, and as the best of any of the oils in the market.

Int. 68. Have you known anything of efforts on the part of that com-

pany, or those connected with it, to improve the character of their oil? If so, will you state over what period those efforts have extended, and what objects they have had in view?

Ans. I have known for the last few months that they had effected a very essential improvement and an entire change in the character and qualities of their lubricating oil, as well as in the mode of its manufacture. I also learned at the same time that those efforts had been made for a year previous to the time when I first learned of their results. During the earlier years I knew they were constantly making efforts to improve their lubricating oil, not only in color, but in lubricating qualities.

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Int. 69. What was the improvement in color which they sought to obtain?

Ans. They sought to obtain a lighter color.

Int. 70. Previously to the making of the improved oil which you speak of, what was the color of their oil, and how did it compare with your own?

Ans. I think the color might be called an orange-color previously to this. The color of theirs and ours was very similar. It might be called the same thing.

Int. 71. Did their oils or your own, say two or three years since, have a greenish or bluish tint, often possessed by paraffine oils, and which has to some extent been a characteristic of them?

Ans. They did, when viewed by reflected light.

Int. 72. You speak of an oil of the Downer Oil Company with which you have become acquainted within a few months, and of its being essentially different from what you had known before. In what respects does it differ from their oil as you had known it before, or from your own oil, or from that of other manufacturers?

Ans. Its most essential points of difference are, first, its high boiling-point when compared with other oils; its light specific gravity when compared with other oils having sufficient body to be used as lubricators; the almost entire absence of volatile oil; its greater freedom from odor and color.

Int. 73. Have you examined it or experimented with it sufficiently to ascertain whether it is capable of being used as a lubricating oil without mixture with other oils?

Ans. I have not tried its lubricating qualities. I have made no experiments with a view of determining its lubricating qualities.

Int. 74. As a person skilled in the manufacture of oils, do you regard the production of this oil as an important improvement in the art?

(Objected to, as being leading and incompetent.)

47 Ans. I do, in several points. First, it accomplished the removal of the volatile bodies, which I had sought in vain to remove. It also deodorized the oil, as well as very greatly increased the quantity that could be made from the crude oil used.

Adjourned.

FRIDAY, *Oct.* 28, 1870.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. You have spoken of your efforts to make a lubricating oil from coal-tar, which should be free from offensive odor, as unsuccessful. Do you know of any process by which that can be accomplished?

Ans. Not on a commercial scale.

Cross-int. 2. What is it about the constitution of coal-tar which makes such a thing commercially impracticable?

Ans. The hydrocarbons derived from coal-tar are so many of them

offensive themselves that the few that are not offensive would not pay the expense of their separation.

Cross-int. 3. In your thirtieth answer on direct examination, you say that from the substances there mentioned you succeeded in producing what you regarded at that time as a good lubricating oil, etc. What was the character of the treatment of those substances by which you obtained this result?

Ans. Distillations, combined with treatment with acids and alkalies.

Cross-int. 4. Will you describe briefly the mode of distillation which you employed for that purpose?

Ans. The method of distillation employed for that purpose differed somewhat for each crude article that was employed. If the article was coal, the first distillation was that known as a destructive distillation; the others ordinary distillations. If petroleums, only the ordinary distillation. By the destructive distillation, I mean a distillation that entirely changes the character of the substance. By ordinary distillation I mean a distillation by which one volatile body is removed from another of less volatility, or from fixed bodies held in solution or suspension.

Cross-int. 5. At what stage of the process and for what purpose did you use the acids and alkalies?

48 Ans. We used the acids and alkalies, after one or more distillations, for the purposes of removing such bodies as would combine with them, and for changing the character of other bodies.

Cross-int. 6. Were the acids used for cleansing the oil from impurities?

Ans. Yes, sir. That is another way of stating the object.

Cross-int. 7. Were the alkalies used to remove the acids after the cleansing had been accomplished?

Ans. That was one of the objects of using the alkalies.

Cross-int. 8. What were the others?

Ans. To get their own specific action upon the oils.

Cross-int. 9. What was that?

Ans. To remove volatile acids existing in the crude oils, and to break up sulphur compounds and other objectionable bodies which are destroyed by the action of alkalies.

Cross-int. 10. How were these sulphur compounds produced?

Ans. In the destructive distillation of coals and shales, and other bodies containing sulphur.

Cross-int. 11. Will you explain briefly what this destructive distillation is, and how it produces the sulphur compound?

Ans. By the destructive distillation we take the coal, which is not volatile, does not contain paraffine or hydrocarbons properly so called, but consists of carbon, hydrogen, oxygen, and in some cases nitrogen, together with earthy substances, sulphuret of iron, and may contain other bodies, and submit it to a high heat. The elements tend to form new combinations, the iron not having sufficient affinity for the sulphur to remain in combination with the whole of it; the carbon and hydrogen having affinity for the sulphur, they unite, forming a variety of different compounds containing sulphur in their composition.

Cross-int. 12. In producing your lubricating oil from petroleums, did you use petroleums which were the result of a destructive distillation?

Ans. The petroleums we used were natural products. It is a matter of theory whether they are produced by destructive distillation or not. They were crude petroleums.

Cross-int. 13. In your treatment of these crude petroleums did any destructive distillation occur?

49 Ans. That depended upon the particular petroleum upon which we might be operating, some of the petroleums holding fixed bitumen in solution.

Cross-int. 14. In your treatment of those which did not hold fixed bitumen in solution, did any destructive distillation occur?

Ans. Not to that extent to give that character to the distillation known as destructive distillation. Still, in all cases where oils having a high boiling-point are distilled in the ordinary manner a small portion of the oil is changed in character, although the larger proportion distils unchanged.

Cross-int. 15. By distillation in the ordinary manner you mean distillation by common heat?

Ans. By any mode of heat that would perform the distillation readily; the heat being applied to the surface of the still or vessel holding the body to be distilled.

Cross-int. 16. Can you explain a little better what you mean by distillation in the ordinary manner, as distinguished from any other mode?

Ans. By distillation in the ordinary manner I mean a distillation where the body to be distilled is put into a vessel of any convenient shape or material, closed from the air, with the exception of one or more pipes or tubes leading from that vessel, known as the still, to a considerable length of pipe or tube coiled or arranged in any other convenient manner, and cooled by currents of water or any other means of cooling so as to retain some portion of it near to that of the temperature of the air; heat being applied to the still by any means, so as to convert the substance into vapor, and drive that vapor through the pipe or tube leading to the pipe or tube cooled by any means, and known as the condensers, where the vapor was condensed or returned to the liquid state, and run out of the open end of the pipe so placed as to receive it. This, as distinguished from any other mode of distillation, is that this involves all that is absolutely necessary to distill a body capable of distillation. Any modification of this, as the introduction of direct steam into the mass of the body, or the production of a partial or perfect vacuum, or the maintaining of a pressure greater than that of the ordinary pressure of the atmosphere, or distilling slower than the ordinary working capacity of the still, I should call a modified form of distillation.

50 Cross-int. 17. Does destructive distillation come from the use of such a degree of heat as decomposes or breaks up the material in the still, resulting in the production of more volatile compounds?

Ans. That is not exactly what I mean by destructive distillation. By destructive distillation I mean the application of the process of distillation to a body not already volatile, thereby converting it into bodies fixed and indestructible by heat, and new bodies that are volatile, or permanent gases.

Cross-int. 18. In the operation of obtaining illuminating oil by distillation from petroleum, may or does destructive distillation occur by the application of a comparatively high degree of heat for the purpose of increasing the yield of illuminating oil?

Ans. Action takes place very similar, still somewhat different from what we understand by destructive distillation, by which action bodies are modified or changed in some of their characters without being entirely changed in all of them. At the same time, some of those bodies are distilling unchanged, while perhaps it might be said that a very small

portion was undergoing a destructive distillation proper, giving the distillation somewhat of a mixed character.

Cross-int. 19. What are the bodies which are undergoing this modification you speak of, and what is the modification which they undergo, in the operation referred to in the last question?

Ans. The bodies are those known as hydrocarbons, being composed of carbon and hydrogen. The modification that I referred to consists in changing their boiling point or degree of volatility, and their specific gravity, as well as mobility, without essentially changing their composition or many of their other characters.

Cross-int. 20. In the action you speak of, is some portion of the hydrocarbon acted upon, converted into a volatile compound which goes over to the condenser, and the other part of it dropped back into the still, or left in the still?

Ans. Yes, sir.

Cross-int. 21. What is this substance which so falls back into, or is left in the still?

Ans. At first it is a hydrocarbon, but by repeating the operation a residue is finally obtained consisting of carbon alone, or what we call coke.

51 Cross-int. 22. In the action you speak of in the nineteenth and twentieth answers, just given, is not paraffine broken up, so that part of it goes over to the condenser in volatile compounds, and the residue falls back into or remains in the still?

Ans. Undoubtedly that action applies to the paraffine as well as to the other hydrocarbons.

Cross-int. 23. When this action takes place upon the paraffine, are sulphur compounds produced, which remain in the still?

Ans. Not essentially.

Cross-int. 24. What do you mean by essentially in this connection?

Ans. By that I mean that if the bodies were absolutely free from sulphur the action would still take place. If they contained sulphur the sulphur compounds would be produced.

Cross-int. 25. Did you use alkalies in making the lubricating oil I have been inquiring of, for the purpose of removing offensive odor from the oil?

Ans. Yes, sir.

Cross-int. 26. Why was not the offensive odor removed by the distillation?

Ans. Because there were volatile bodies there having offensive odors that distilled with the other bodies. At the same time other bodies, having offensive odors, were formed by this modifying action referred to in a previous answer, which was always taking place whenever a heavy oil, or an oil having a high boiling point, was being distilled.

Cross-int. 27. Are the sulphur compounds of which you have spoken easily recognized; and, if so, how?

Ans. They are. Many of them by a simple application of a solution of any metallic salt containing metal, that forms an insoluble compound with sulphur, as well as by their well-known peculiar odor, or by any of the analytical methods of detecting sulphur.

Cross-int. 28. If I understand you, these sulphur compounds were the main source of the offensive odor which you used alkalies to remove; am I right?

Ans. I did not so wish to be understood.

Cross-int. 29. What other offensive odor was there, which you desired to remove by the use of the alkalies?

52 Ans. The odor of a variety of acid compounds, of which carbolic acid or phenic acid may be taken as a type.

Cross-int. 30. Are these acid compounds in the crude petroleum, or are they the results of destructive distillation, or of the modifying action partaking of the character of destructive distillation, which you have mentioned?

Ans. I do not know of any petroleum that contains any of these acids, neither are they produced by any of the ordinary distillations applied to petroleum, in appreciable qualities.

Cross-int. 31. In which of the substances you worked upon for the purpose of making your lubricating oil did such acids exist?

Ans. In the crude oils obtained from the Breckenridge coal, and all the similar coals, from many of the shales as well as those from some of the bitumens, also the oil obtained from coal-tar.

Cross-int. 32. Did you make lubricating oil from any substance; and, if so, what; in which there were none of these acid compounds?

Ans. Yes, sir; from petroleums; that is, none that were in sufficient quantities to be noticed in any manufacturing operations.

Cross-int. 33. In making lubricating oil from petroleums did you have to use alkalies?

Ans. Yes, sir.

Cross-int. 34. For what purpose?

Ans. For the purpose of neutralizing the acids that we used in their purification.

Cross-int. 35. Do you know whether or not, in the manufacture of the Merrill lubricating oil, so called, as actually carried on, acids are used for cleansing the oils from impurities after it has been deodorized by distillation?

Ans. I should think not strictly for that purpose, but rather for the purpose of bleaching or removing the color; as I should not myself regard the oil any better as a lubricator for any chemical treatment that it might receive. In this answer I refer to the oil made by the Downer Kerosene Company, under Merrill's patents.

Cross-int. 36. How does the acid remove the color? What does it attack for that purpose?

Ans. It attacks some bodies that are somewhat modified, thereby rendering them more susceptible to the action of acid, in chang-
53 ing to some extent the color of the other bodies, so that by after-treatment the color is changed or removed to a great extent.

Cros-int. 37. What do you refer to by the after treatment?

Ans. Treatment by alkalies, for the purpose of removing acids.

Cross-int. 38. What are the bodies producing the objectionable color which the acid attacks?

Ans. Probably hydrocarbons. Perhaps tarry matter is as correct a term to describe it by.

Cross-int. 39. If I have understood you correctly, when you made your lubricating oil from petroleums, you used acids, and afterwards alkalies, for the same purposes for which they are used in the manufacture of the Merrill patent lubricating oil. Am I right?

Ans. Yes, sir. There are two purposes the same in the use of acids and alkalies, one of which is the removal of objectionable bodies that will combine with them, the other of which is to bleach, or modify their color.

Cross-int. 40. In making lubricating oil from petroleums, you used acids to cleanse the oil from impurities, and alkalies afterwards to remove the acids?

Ans. Yes, sir.

Cross-int. 41. What was the general character of these impurities?

Ans. They were essentially of a tarry nature, easily liable to change, and of somewhat offensive odor.

Cross-int. 42. These were tarry matters of the same character, if I understand you, as those which acids are employed to remove in the manufacture of the Merrill patent lubricating oil?

Ans. Yes, sir. The tarry matters that are associated with all crude petroleum.

Cross-int. 43. Except so far as you removed these tarry matters by the use of acids, the deodorization of your lubricating oil made from petroleums was accomplished by the distillation, so far as deodorization was effected at all. Is that so?

Ans. Yes, sir.

Cross-int. 44. You said that when your lubricating oil, of which we have been speaking, was mixed in about equal proportions with fatty oils, the characteristic odor of such oil was perceptible in the compound. Was this true of your lubricating oils made from petroleums, as
54 well as of your lubricating oil made from the other substances which you produced it from?

Ans. Yes, sir; I should say it was; at least with a considerable number of the fatty oils. There may have been some of the fatty oils in which it was impossible to detect their odor in the compound.

Cross-int. 45. Did you try your lubricating oil made from petroleums in a mixture with fatty oils in the proportion of twenty-five or thirty per cent. of the lubricating oil?

Ans. I do not recollect any mixture of that particular character, that I made myself.

Cross-int. 46. Speaking of experiments of yours, since the organization of your company in 1859, you say that one of the particular improvements in your lubricating oil, which you have sought to effect, has been the removal of the oils known to be associated with it, and of themselves too thin for lubricating oils. Were these associated thin oils the volatile compounds which you had previously removed, with more or less success, by distillation?

Ans. No, sir. Those that I referred to particularly in that connection were those formed at the time that that oil was last distilled.

Cross-int. 47. You say you have some experiments not finished, by which you endeavored to remove the volatile oils by distillation without distilling the heavy lubricating oils. What did you do for this purpose other than to regulate your distillation with care and skill?

Ans. I combined the use of superheated steam with that of a direct fire so as to remove the volatile bodies without so far charring or blackening the remaining oils as to prevent their being subsequently bleached.

Cross-int. 48. Was the use of the superheated steam to blow off some volatile compounds, and by facilitating the escape of others under the action of fire distillation, to render a less degree of heat necessary?

Ans. Perhaps that may explain my object; I should say, however, to enable the distillation to take place at a lower temperature.

Cross-int. 49. Can those volatile compounds, which you so sought to remove from the heavy or lubricating oils, be removed by the mere use of fire-heat, and without the charring or blackening of the remaining oil, that you spoke of?

Ans. It may possibly be done, but hardly in a practical manner.

55 Cross-int. 50. When was it, as nearly as you can give the time, that you first treated your oil with fire-heat and superheated

steam combined, for the purpose of ridding it of the volatile compounds?

Ans. It was during my brother's life-time. He died two years ago the fifth of the coming November. He was confined to the house before he died, about a month, and this experiment was the last thing that he ever did.

Cross-int. 51. You speak also of having employed fractional condensation; was this before you used superheated steam, together with fire distillation; if so, how long before?

Ans. It was before; I should say at least seven or eight years.

Cross-int. 52. In the same answer, viz, the sixty-fourth, you say, "In regard to the results, I have very much improved the quality of our oil at the expense of the quantity made," etc. Has this improvement gone on gradually during the last seven or eight years?

Ans. It has.

Cross-int. 53. Do you make now a hydrocarbon oil for lubricating purposes, substantially free from offensive odor?

Ans. Yes, sir.

Cross-int. 54. At what point during the last seven or eight years did you begin to make a hydrocarbon oil for lubricating purposes, substantially free from offensive odor?

Ans. I should call our lubricating oil during the whole of that time substantially free from offensive odor, but not free from odor.

Cross-int. 55. Has your lubricating oil during the whole of that time been made with a sufficiently good color, and a sufficient body, for lubricating purposes?

Ans. Do you mean when applied alone, unmixed?

Cross-int. 56. Please answer both ways, as to its use alone, and as to its use in combination with fatty oils.

Ans. The color—we have had very little objection to that. As to the body, very few of our customers use it unmixed. They mix it with fatty oils.

Cross-int. 57. You say that your lubricating oil has been, during the last seven or eight years, substantially free *free* from offensive odor, but not free from odor. Has the odor which it has possessed materially affected its usefulness, or its salableness, as a lubricating oil?

56 Ans. I could hardly say that it has, for the reason that we have always had a ready sale for all that we have made.

Cross-int. 58. In making this oil, you say that you have improved the quality of your oil at the expense of the quantity made; preferring to put a first-class article into the market in moderate quantities, rather than larger quantities of an inferior quality. Do you mean that you sacrifice quantity to quality, by freeing the oil more and more from volatile compounds?

Ans. Yes, sir; and by freeing it also from the thinner and lighter oils that might be used as lubricating oils.

Cross-int. 59. What percentage of the whole oil did you remove in the shape of these volatile compounds, and of these thinner and lighter oils?

Ans. From our mode of separation that question hardly admits of a definite answer, other than to give the per cent. of finished lubricating oil obtained from the crude used; between two and a half and three per cent. of finished oil.

Cross-int. 60. What proportion does the finished lubricating oil bear to the paraffine oil which you subjected to distillation, either with or without superheated steam?

Ans. That submitted to the distillation of superheated steam was our regular machinery oil division.

Cross-int. 61. Do you use superheated steam now?

Ans. We do not.

Cross-int. 62. What distillation do you use?

Ans. The ordinary plain fire distillation.

Cross-int. 63. And what proportion does the finished oil bear to the paraffine oil which you submit to that distillation?

Ans. In our ordinary modes of fractional distillation we get about fifty per cent., I should think, on the last distillation.

Cross-int. 64. Speaking of the oil of the Downer Oil Company, with which you have become acquainted within a few months, do you mean the Merrill patent lubricating oil, so called?

Ans. I do.

Cross-int. 65. How does the boiling point of that oil compare with the boiling point of the hydrocarbon lubricating oil which you made, say five or six years ago?

57 Ans. The boiling point of the Merrill oil is from one hundred and fifty to two hundred degrees higher than ours. Our boiling point was about four hundred and twenty-five to four hundred and fifty degrees.

Cross int. 66. How does its specific gravity compare with the specific gravity of yours at the time inquired of?

Ans. I should think it was two or three degrees lighter. I have seen but a few specimens of this oil.

Cross-int. 67. The hydrocarbon lubricating oils are, as a class, considerably cheaper than the fatty oils commonly used for lubricating, are they not?

Ans. They are.

Cross-int. 68. Are they to some extent, and by some dealers, used to adulterate the fatty lubricating oils, which are then sold as fatty lubricating oils?

Ans. They are said to be largely so used.

Direct resumed:

Int. 75. Do you consider the lubricating oil which you manufacture at the present time, as good as the oil manufactured by the Downer Company under Merrill's patent?

(Objected to as leading.)

Ans. As good in its lubricating qualities, do you mean?

Int. 76. Yes, and for all purposes for which they are respectively used.

(Objection continued.)

Ans. As a lubricating oil I think it is; but not for mixing with other oils, where it is desired that its own peculiar smell shall not appear.

Int. 77. When you say as a lubricating oil, what do you mean by that expression in this particular comparison?

Ans. When the only object is a good lubricator, without regard to odor, and without regard to the sale to another party. In other words, with regard to its actual use.

Int. 78. You have spoken of the extent to which your oil is used for lubricating, without being mixed with other oils. Do you know to what extent the oil manufactured by the Downer Company, under the Merrill patent, is used in the same way? If so, state what knowledge you have on the subject.

58 Ans. I have no other knowledge on the subject than what I have heard in the evidence in this case, and what Mr. Merrill has

told me within a few days; that is, I have no knowledge from the consumers.

Int. 79. In speaking of the purification of your oil, you mentioned that you attempted to remove the odors arising from sulphur compounds and from some acids, such as phenic and carbolic acids. To what extent did you succeed in removing the odors due to those bodies?

Ans. I think we removed all the odors that arose from any of those bodies.

Int. 80. If after their removal there still remained an odor, state what it was, and whether it would have been desirable to remove that also.

Ans. There still remained the odor of the volatile oils, which were always present. It was certainly desirable to remove any odor arising from any source.

Int. 81. Can you tell us whether paraffine exists in the crude petroleum of this country, or is a product generated in the process of distillation?

Ans. There are hardly any facts existing which will prove from which of those two sources it is derived, there being two theories upon that subject; one of which is that it exists ready formed, the other that it is only the product of heat applied to those petroleums. I do not know of its ever having been separated from the ordinary crude petroleums by any means where heat has not been used; still, it is so readily formed, that it could hardly seem as though it was produced by distillation, or by the re-arrangement of the elements composing petroleum. If you want my opinion or theory, I should say that it existed ready formed, in crude pretroleum, but was prevented from crystallizing by being dissolved in a large quantity of liquid hydrocarbons and tarry matter, that prevents the formation of crystals.

Int. 82. You mentioned using alkalies in the purification of your oils, after they had been treated with acids; are there any cases where you use alkalies before the acids are used? If so, for what purpose?

Ans. Yes, sir. It is usual, or has been, in removing acids like carbolic acid or phenic acid from oils produced from coal-tar, or coals, or shales, or any other substances that yield them.

59 Int. 83. You mentioned the use of superheated steam in some experiments you and your brother made some two years since. In those experiments was the steam thrown directly into the oil in the still, rising through it, and passing over into the condenser?

Ans. It was.

Int. 84. When did you first have any knowledge of the use of heated steam in that way in the distillation of oils?

Ans. In the experimental way, as long ago as 1851 or '52.

Int. 85. Have you had any knowledge of such use of it in the practical manufacture of oils in this country? If so, within what period, and to what extent?

Ans. I have never known of its being used with any practical advantage whatsoever, until the application in the process of manufacturing Merrill's deodorized oil. By that I mean there was no object gained that could not have been gained by ordinary distillation to much better advantage.

Int. 86. My question referred to the fact of its use rather than to the advantages of its use. To what extent have you known of its being used in fact, either with or without results, that might have been better attained by other modes?

Ans. I don't know that it has been continuously in any case. I think all the use of which I know would be classed under experimental use.

Cross-examination resumed:

Cross-int. 69. Name the parties, as you now remember them, who have made such use of superheated steam.

Ans. The first use in this country, that I knew of, was for distilling coup oil, manufactured at Waltham, Mass. I will add the New York Kerosene Oil Company; Dr. Tweddle, of Pittsburg; I have heard also of perhaps four or five other parties, whose names do not now occur to me.

Cross-int. 70. (De bene.) Comparing your lubricating oil with the Merrill patent oils, you say you think yours not so good for mixing with other oils when it is desired that its own peculiar smell shall not appear; and on your direct examination you mentioned, among the peculiarities of the Merrill patent oil, its greater freedom from odor. Do you mean that it is freer from odor than yours?

60 Ans. Yes, sir.

Cross-int. 71. Is the odor which it has of the same character as that which yours has, but less in degree?

Ans. I hardly think it can be said to be of the same character. It is a different odor, I should say.

Cross-int. 72. How does it differ?

Ans. By being less tenacious; or, in other words, one can be completely covered up with a smaller amount of any other odor than the other.

WM. ATWOOD.

Deposition of Francis Maguire, taken before H. Farnam Smith, esq., special examiner, Friday, Oct. 28, 1870.

Direct examination by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Francis Maguire; forty-six years of age; reside at Cambridge, Mass. I am a manufacturer and dealer in oils and candles.

Int. 2. What class of oils do you manufacture, and what class of oils do you sell other than that which you yourself manufacture?

Ans. I manufacture sperm, whale, and lard oils, and sell, besides these, machinery and wool oils, compounded from lubricating oils and the fatty oils.

Int. 3. To what oils do you refer as lubricating oils, in that answer?

Ans. Oils refined from petroleum or coal oils.

Int. 4. How long have you been acquainted with these paraffine oils, and to what extent have you dealt with them, and to what class of persons have you sold them?

Ans. I have been acquainted with them for twelve or thirteen years, and have dealt in them, to the extent of one-quarter or one-third of my business; and have sold to machine-shops, railroads, factories, woollen and cotton, and for machinery purposes generally. Some lubricating oils I have known for eighteen or nineteen years.

61 Int. 5. Do you or not, in your business, sell any paraffine oil for lubricating purposes, simple and uncompounded with fatty oils; and, if so, how much?

Ans. The extent of my sales of that material is very slight.

Int. 6. What sort of an oil do your customers seek to obtain for use as a lubricator?

Ans. Such an one as I can compound with the nice fatty oils, using the lubricating oils of the best ordinary material I can find of sufficient body.

Int. 7. What characteristics do they desire the compound oil which you sell them to possess, as to body, odor, and color?

Ans. They require a body as nearly as possible of the body of lard oil. The color would be satisfactory if not darker than a lemon, and the odor of the best of the ordinary oils is not objected to.

Int. 8. What characteristics do they desire in oils which are to be used upon wools?

Ans. Oils that are entirely free from the characteristic odor of petroleum oil.

Int. 9. Are you or not familiar with what is known as Merrill's deodorized oil; and, if so, how long have you known it, and to what extent have you used it in your trade, if at all?

Ans. I have been familiar with that since the spring of 1859, and have used it quite largely in my trade, and its use is increasing.

Int. 10. State for what purposes and in what proportions, when compounded with other oils, and with what results you have used it in your trade.

Ans. Chiefly as a wool oil combined with other oils. It combines in all proportions. It is used chiefly in the proportion of one-quarter fatty oil to three-quarters of the Merrill oil. The results in my business have been quite satisfactory. There has been no complaint whatever from parties who have used it.

Int. 11. When combined in those proportions with fatty oil, what is the nature of the compound as to odor and color?

Ans. No oder will be perceptible except the odor of the fatty oil. The color is influenced by the color of the fatty oil.

Int. 12. In what proportions did you, in your trade, combine the paraffine oils you used before you used Merrill's oil, and with what results?

62 Ans. In all proportions, from ten per cent. to seventy-five. They were not combined for the same uses as the Merrill oil.

Int. 13. For what uses was the combination made, and why were they not combined for the same uses as the Merrill oil?

Ans. They were used for general machinery purposes, and their character was such that I did not think them adapted for wool uses.

Int. 14. In what respect was their character such you did not think them adapted for wool uses?

Ans. Chiefly because they had too much of the pungent smell of paraffine oils, and too low a boiling-point.

Int. 15. Whether or not you received any complaints from your customers who purchased the compound oil for machinery use composed of the paraffine oil in the market before Merrill's, and the fatty oils; and, if so, what those complaints were?

Ans. The complaints were frequently made of the smell arising from the use of these oils and their liability to run black on machinery, owing to the presence of acids.

Int. 16. Prior to the period when you became acquainted with Merrill's oil, were you acquainted with any paraffine oil which resembled it in body, odor, and color, and in the uses to which its characteristics enabled it to be put in your trade?

Ans. No, sir.

Int. 17. Since you have known and dealt in Merrill's oil, have you been acquainted with other oil in the market which in these respects was similar to Merrill's oil, and which you have used for the same purposes in your trade?

Ans. I have known the Eclipse topaz oil as such.

Int. 18. Do you know by whom and where the Eclipse topaz oil is made?

Ans. Made in Pittsburg by Mr. Tweddle, as I am informed by the agent.

Int. 19. State whether you have used the topaz oil in combination with fatty oils to produce an oil for use upon wools?

Ans. I have.

Int. 20. What was the result?

Ans. It made an oil, to all appearance, practically as good as Merrill's.

63 Int. 21. State if you know in what proportion it can be mixed with fatty oils, and produce an oil suitable for use upon wool.

Ans. In any proportion, from twenty-five to seventy per cent.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. Why did you fix upon lemon-color as the proper color for a lubricating oil?

Ans. Customers generally are better pleased with an oil of a light color, a light color approaching sperm, and the best qualities of paraffine oil have been of that color.

Cros-int. 2. If the paraffine oil be of about an orange-color, its presence in sperm oil when such a mixture is made can be perceived by the color, can it?

Ans. Not particularly by that color; as sperm oil varies from lemon to orange, and sometimes a good deal darker.

Cross-int. 3. The color of the best sperm oil I understand you is about of a lemon-color?

Ans. Usually.

Cross-int. 4. And such a grade of sperm oil can be mixed with a considerable proportion of the Merrill patent lubricating oil, which is also lemon-color, and substantially odorless, without its being perceived by ordinary purchasers that there is anything in but sperm oil, can it?

Ans. It wouldn't be apparent to taste or smell, but might be detected by the shade.

Cross-int. 5. You mean by the bluish tint?

Ans. Yes.

Cross-int. 6. Would the presence of the Merrill patent lubricating oil, so mixed with sperm oil, be detected in any way, in the use of the oil for lubrication?

Ans. I think not.

Cross-int. 7. Does not sperm oil of a good quality contain all the requisites as to body, color, and odor which a lubricating oil needs to have?

Ans. It does.

64 Cross-int. 8. Does it cost more than Merrill's patent lubricating oil?

Ans. Yes, sir.

Cross-int. 9. How much more?

Ans. From two and a half to three times as much.

Cross-int. 10. Give the present wholesale price of the two articles.

Ans. Sixty cents for Merrill's. One dollar and forty-five to one dollar and sixty cents for sperm.

Cross-int. 11. Do not some dealers sell, at or about the price of sperm oil, a sperm oil which has mixed with it more or less of Merrill's patent lubricating oil?

Ans. Not to my knowledge, as I have never bought any.

Cross-int. 12. Did you ever do so?

Ans. I have mixed these oils in all kinds of proportions, but have not sold them, unless the parties knew it.

Cross-int. 13. Why did the pungent smell of paraffine oils, which you say existed in the paraffine oils you used before you used Merrill's, make it unsuitable for wool use any more than for any other lubricating use?

Ans. Because this odor would remain in the goods after the goods were manufactured.

Cross-int. 14. When you say that it was objectionable for wool use for the further reason that it had too low a boiling-point, do you mean that by reason of the volatile oil it contained there was special danger of spontaneous combustion, so called?

Ans. By reason of the volatile oils that it contained it was more liable to smell, and give off vapors and odors at a low temperature.

Cross-int. 15. Are lubricating paraffine oils preferred for general lubricating purposes, in proportion as they are free from such volatile compounds, other things being equal?

Ans. They are.

Direct examination resumed:

Int. 22. How does the compound oil formed from Tweddle's Topaz oil in combination with fatty oils compare with that formed from Merrill's and fatty oils, as to the blue tint spoken of?

Ans. The difference is very slight.

65 Int 23. When you say the difference is very slight, do you mean that one has somewhat more of it than the other; and if so, which has the most?

Ans. I think there is a very little more in Tweddle's than in Merrill's.

Int. 24. At what price have you in your business been accustomed to sell the oil compounded with Merrill's oil, as compared with the price of sperm oil at the same period?

Ans. Generally about half the price of sperm.

Int. 25. State whether or not the customers who purchased this compound oil inquire for and know that they obtain a compound oil, and not a pure sperm.

Ans. They all know it as a compound.

Int. 26. Whether or not the mixing of Merrill's oil with lard and whale oil has an effect, from the antiseptic nature of Merrill's oil, in improving the character of the compound, as compared with the whale or lard oil when pure.

Ans. It improves them both when used for lubricating purposes.

Cross-examination resumed:

Cross-int. 16. How many times, and in what quantities, have you examined what you call Tweddle's Topaz oil, in comparison with Merrill's patent lubricating oil, and have observed that the former has more of the bluish tint than the latter?

Ans. I made a general comparison at the time I had the Topaz oil, and that was the result of the experiment that I made. My experiments consisted in examining them by the eye.

Cross-int. 17. Have you ever heard any complaints in regard to Merrill's patent lubricating oil, that it left a stain on textile goods made on machinery lubricated by it, when such goods were washed?

Ans. No, sir.

FRANCIS MAGUIRE.

66 *Deposition of James A. Treat, taken before H. Farnham Smith esq., special examiner, Monday, Oct.* 31, 1870.

Direct examination by Walter Curtis, esq., in behalf of the complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. James A. Treat. I am sixty-four years of age. Residence in Lawrence, Mass. I am a dealer in manufacturers' supplies in Lawrence.

Int. 2. Whether or not you furnish manufacturing corporations oils for lubricating and other purposes; and if so, to what class of manufacturers you furnish them?

Ans. I furnish oils to cotton, woolen, and flax manufacturing companies, and to large and small machine-shops.

Int. 3. Whether or not you are familiar with the paraffine oils in this market; and if so, how long have you been so, and to what extent you have dealt with your customers in them?

Ans. I am familiar with the paraffine oils in the market, and have been for the last eight or ten years. I should think three-quarters of the lubricating oils sold by me have been paraffine oils.

Int. 4. Are you acquainted with the paraffine oil made by the Downer Kerosene Company under Merrill's patent?

Ans. I am.

Int. 5. How long have you been familiar with it, and to what extent have you dealt in it during that period?

Ans. I have been acquainted with Downer's spindle oil for about eight years. I have been acquainted with the patent oil about two years. I have sold it to the extent of three-quarters of the paraffine oil I have sold during the last two years. I have sold no paraffine oil within the last two years, excepting what I have purchased of Mr. Downer, but whether some machinery oil which I bought of him was made under the patent I dont know.

Int. 6. Whether you sell in your business, at present, Merrill's patent oil for use in cotton-mills, pure, or compounded with fatty oils, or in both forms.

67 Ans. I sell in both forms. Nine-tenths of all my sales are of the simple oil.

Int. 7. State, if you know, the precise uses to which it is put by cotton manufacturers, and describe the general characteristics which such manufacturers require the oils put to those uses to possess.

Ans. It is used for lubrication on the journals of the machinery in its simple state, and also in its compound state. It is also mixed with a fatty oil to sprinkle upon wool in the place of olive oil. The characteristics which they want in oil are good body, no odor, or as little as possible, and they prefer a light color; this color is not always essential, but they prefer it in the market; also to be as free from all acids as possible, and from all properties that would tend to stain or leave a permanent stain upon the yarn.

Int. 8. With what fatty oils and in what proportions is Merrill's combined for use upon wool?

Ans. I don't mix it myself. It is mixed with lard by the manufacturers of the oil; in what proportions I don't know. I am the agent for the sale of Maguire's patent wool-oil, which is a compound of paraffine with lard or olive oil. I am now speaking of the wool-oil so called.

Int. 9. Before this wool-oil, of which you have just spoken, came into the market what was the standard oil for wool-use among your customers?

Ans. Olive and lard oil.

Int. 10. So far as you know, is sperm oil used for this purpose at all?

Ans. As far as I know, it is not.

Int. 11. whether or not, prior to the time when you sold to your customers Merrill's patent oil, you had any complaints from them of the paraffine oils you then dealt in, with regard to body, odor, and color; and if so, state what those complaints were.

Ans. The complaints were numerous, and my sales fell off. They were of want of body, and principally from the offensive odor of the oil, and some complaint of color; though not a serious one, as to color.

Int. 12. Whether or not any of your customers ceased to use paraffine oils altogether?

Ans. Some of them did. Many decreased their orders for paraffine oils, even when used on large journals.

68 Int. 14. What have been the facts in your trade in this respect since you began to sell Merrill's oil?

Ans. Many customers have resumed their orders, commenced using the paraffine oil again, and some who have never used paraffine oil have now commenced to use it.

Int. 15. You speak of Merrill's?

Ans. Of Merrill's patent oil.

Int. 16. Whether you have had any complaints from the purchasers of Merrill's oil as to odor, body, and color?

Ans. I have heard no complaints of this Merrill's oil so far as odor, body, and color are concerned.

Int. 17. Do you know of any other paraffine oil in the market at present which fills substantially the same place in the market, and is capable of the same uses, so far as your trade is concerned, as Merrill's oil?

Ans. Several agents have presented me with samples of oils called the Tweddle's Eclipse oil and Tweddle's Topaz oil, and Eclipse oil manufactured in Pittsburg, Pennsylvania. Those oils, even at the lowest price which is offered, of fifty cents and fifty-seven cents, resemble the Merrill's oil in body, color, and odor. These come in competition with the Merrill oil only from the price, the price being less.

Int. 18. When you say they come in competition only from the price, do you mean to be understood that they are capable of the same uses or not?

Ans. I do. They are nearly the same article, as nearly perhaps as they could come without chemical analysis, and I don't know even then.

Int. 19. What is the price of Merrill's oil as compared with this Tweddle's oil which has been offered to you—the Topaz oil?

Ans. Merrill's wholesale price is sixty cents. The Tweddle Topaz oil from fifty-five to fifty-seven cents. There is what is called the Eclipse oil, purporting to be manufactured by Tweddle, only fifty cents. I know the price of the Merrill's from the manufacturer, direct. The prices of the other oil I only know from the agent.

Int. 20. What is the price of the wool-oil for which you are agent, compared with the price of oils used upon wool before Merrill's oil was introduced?

69 Ans. From a third to one-half less. The wool oil I give prices of to-day at wholesale. Eighty cents per gallon for Maguire's oil, for which I am agent. The best of lard oil, about one dollar and twenty-five cents. Pure olive, one dollar and forty cents to one dollar and forty-five cents per gallon. These oils have dropped; therefore the comparative difference in the price is not so great as it was a year ago. The

tendency of the introduction of this new article has been to lessen the price. There are also, no doubt, other commercial causes for reducing the price from two dollars and seventy-five cents to what it is selling for now.

Int. 21. Whether or not your customers like Maguire's wool oil as well as the pure olive oil formerly used.

Ans. They not only like it as well, but many of them prefer it.

Int. 22. Besides Tweddle's oils, of which you have spoken, do you know of any other oil in the market which fills the same place as Merrill's oil or not?

Ans. I do not.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. Do the Downer Kerosene Oil Company make any paraffine lubricating oil besides that which you call Merrill's patent lubricating oil?

Ans. They have an oil called machinery oil, or did have, within, say, a year and a half. Whether made under Merrill's patent or not I cannot say.

Cross-int. 2. Is it a paraffine oil?

Ans. So called. As far as I know, it is.

Cross-int. 3. You say that nine-tenths of all your sales of the Merrill patent oil are of the simple oil; that is to say, not mixed with other oils. Is the simple oil which you sell mixed for the most part with other oils before it is used?

Ans. In many cases this oil is used simple. Many manufacturers prefer a small per cent. of fatty oil, especially with the former paraffine oils, or oils that are not called neutral oils. The small per cent. of fatty oils is often put in to destroy the offensive odor from the cheap paraffine oils.

Cross-int. 4. Confining yourself to the manner in which the Merrill patent oil is used, I understand you to say that many manufact-
70 urers prefer a small per cent. of fatty oil in this as in the former paraffine oils.

Ans. They do.

Cross-int. 5. Upon what kinds of machinery is the Merrill patent oil used for lubricating without any admixture of fatty oils?

Ans. It is used on all kinds of machinery, particularly on the spindles.

Cross-int. 6. Is it in its unmixed or simple form particularly suitable for use upon such parts as spindles?

Ans. It is so considered.

Cross-int. 7. Why is it?

Ans. Principally from its body and purity from all acids.

Cross-int. 8. Do you mean that a good heavy body is especially necessary in oil to be used upon spindles and similar parts?

Ans. I don't think that an extra heavy body is absolutely necessary upon spindles, but a sufficient body to adhere during the rapid revolution of the flier or spindle is necessary; some use what we call the live spindle, and others what we call the dead spindle. In either case they have to oil the spindle.

Cross int. 9. Does the addition of fatty oil to the Merrill patent lubricating oil increase its body?

Ans. I don't think it does materially. I should think there was very little difference in the specific gravity of Merrill's oil and of the sperm or lard oil. I mean to convey the idea that there is very little difference in what we call the body of a lubricating oil.

Cross-int. 10. What is the advantage of mixing fatty oils with the Merrill patent lubricating oil for lubricating any machinery?

Ans. It adds adhesiveness and tenacity. I might say especially on machines that are not driven with a great velocity.

Cross-int. 11. What do you understand to be the difference between the adhesiveness and tenacity which is added by the admixture of the fatty oil and the "body" of an oil; or are they the same thing?

Ans. Adhesiveness and tenacity are nearly synonymous terms. I suppose if the oils are nearly of the same specific gravity it wouldn't add anything to the adhesiveness, excepting that when those fatty oils would cool under a higher temperature than the paraffine; in that case they would give greater adhesiveness to the mixture.

71 Cross-int. 12. With what fatty oil is the Merrill patent oil mixed for sprinkling wool?

Ans. Principally with lard, although I might say that I don't know from mixing myself; but I have been informed that lard is used, and I should judge myself that would be the best to use.

Cross-int. 13. What were the paraffine oils for lubricating which you dealt in before you began to deal in Merrill's patent oil? From what parties did you get them?

Ans. Downer's spindle and Downer's machinery oil, purchased of the Downer Kerosene Oil Company.

Cross-int. 14. What was the difference between the color of these oils and that of the Merrill patent oil?

Ans. They were all darker colored than the Merrill oil; more of an orange, and even darker than that.

Cross-int. 15. What do you understand to be the importance, for practical purposes, of that difference in color?

Ans. I don't understand that it adds anything to the lubricating property. The color is a matter of taste with the agents, and it gives it a preference in the sale over a darker color.

Cross-int. 16. Will you give the names of such of your customers as you can remember who complained of the Downer spindle and Downer machinery oil?

Ans. The complaints on account of odor and price, compared with other oils, were numerous. I can't particularly mention any particular manufacturer. I recall, upon reflection, as to price, the Salmon Falls Manufacturing Company; the Cocheco Manufacturing Company, of Dover; the Pemberton Mill, at Lawrence; both on account of price and odor. There was a general falling off of orders from most quarters; and also, I might state with regard to the quality of its staining, it was complained of by the Atlantic Mills, of Lawrence.

JAMES A. TREAT.

72 *Deposition of Joshua Merrill, taken before H. Farnam Smith, esq., special examiner, Wednesday, Nov. 2, 1870.*

Direct examination by Walter Curtis, esq., in behalf of complainant:

Int. 1. What is your name, age, residence and occupation; are you a party to this suit?

Ans. Joshua Merrill; forty-two years of age; residence, Boston, Mass. I am a manufacturer of kerosene oils and other hydrocarbon oils. I am superintendent of the Downer Kerosene Oil Company. I am the complainant in this suit.

Int. 2. Please state generally what your connection has been with the manufacture of oils, and over what period of time it has extended.

Ans. I have been connected with the manufacture and sale of hydrocarbon oils, and my earliest connection with that business was in 1854. I was then connected with the United States Chemical Manufacturing Company, whose works were located at Waltham, Mass., and whose products were principally an oil known as coup oil. I continued my connection with them for about one year. In 1855 I formed a connection with Mr. Samuel Downer, of Boston, as selling-agent of the coup oil before mentioned, and continued with him until 1856, principally occupied during that time in selling this oil to the cotton manufacturers and woolen mills in New England. In 1856 I went to Europe, being employed as expert in the manufacture and sale of the same class of oils, manufactured by George Miller & Co., of Glasgow, Scotland. I returned from Europe in October, 1856, and again began the manufacture of hydrocarbon oils with Mr. Samuel Downer, in South Boston, at the present works of the Downer Kerosene Oil Company. For about one year we manufactured oil from Trinidad asphaltum, Cuba asphaltums, resin, and various other substances. The latter part of 1857, or early in 1858, we began the manufacture of oils from Albert coal, and continued in that manufacture until the development of petroleums rendered the business no longer profitable; since which time I have been largely engaged in the manufacture of petroleum into its products.

73 Int. 3. State whether or not your connection with the business of the Downer Kerosene Oil Company has been and is such as to enable you to state what has been the amount of hydrocarbon oil made and sold during each year at the Downer works from 1860 to 1868, and what the character of the oil sold during that period was.

Ans. My connection is such that I am entirely familiar with the amount of manufacture and sales of oil made by the Downer Kerosene Company, and being the manufacturer, I am perfectly conversant with the character and quality of the oils so made and sold.

Int. 4. Please state what the sales were per annum during that period; what the article sold was; to what class of purchasers and for what uses sales were made, and whether or not they were any of them made for exportation abroad, or were solely for use in this country.

Ans. The sales of oils by the Downer Kerosene Oil Company from 1860 to 1868, as taken from the books of the company, were as follows: In 1860 we sold 61,570 gallons; in 1861 we sold 33,478 gallons; in 1862 we sold 72,102 gallons; in 1863 we sold 136,804 gallons; in 1864 we sold 128,744 gallons. The oils sold up to this latter date were lubricating oils, and made principally from Albert coal. At about this time, 1864, we were largely manufacturing petroleums, but to a small extent from Albert coal; and from 1864 to 1868 the lubricating oils as enumerated below were principally manufactured from petroleum. In 1865 we made and sold 195,000 gallons; in 1866 we made and sold 148,753 gallons; in 1867 we made and sold 106,125 gallons. The class of persons to whom these oils were sold prior to 1865 was almost exclusively to the actual consumers for lubricating machinery. Since 1865 we have sold to both consumers and dealers for the same general purpose. We sold none for exportation prior to 1865. Since that time up to 1868 we exported a small quantity, not exceeding 500 barrels during the whole period.

Int. 5. I observe that the sales made in the two years subsequent to 1865 were less than those made during that year, and those of 1867 less than those of 1866. If you are aware of any reasons why the sales decreased during that period, please state what they were.

74 Ans. The principal reason, or one of the reasons, was an in-

creased production of paraffine oils made from the residuums of petroleum and sold in the market at greatly reduced prices, which caused the consumers and purchasers to somewhat neglect our products and use the cheaper articles instead; we having up to that time manufactured a high standard of paraffine oils, for which we had obtained the highest prices.

Int. 6. Please state whether or not, prior to 1868, the Downer Company sold any of the paraffine oil, such as they were manufacturing from 1865 to 1868, to either of the defendants in this case; and if so, give the quantities sold to either of them, and the prices at which this oil was sold.

Ans. We did sell in 1865 to Mr. Yeomans—the style of the firm then being Smith & Yeomans—paraffine oils as follows, viz: Dec. 4, ten barrels; Dec. 12, ten barrels; Dec. 18, five barrels; and Dec. 20, five barrels —total, thirty barrels. The price was eighty cents per gallon. On Feb. 3, 1868, we sold to Yeomans & Goss ten barrels. All this oil was of the quality sold by the Downer Kerosene Oil Company to other parties, and of like quality to that made from 1864 to 1868.

Int. 7. Whether or not, since the date last mentioned, you have made any sales to either of the defendants; and if so, what quantities you have sold and what the article was.

Ans. During the year 1868 we sold those parties no oil excepting that mentioned; but March 31, 1869, we sold Yeomans & Goss the first lot of my new deodorized hydrocarbon oil, and during the year 1869, from time to time, additional lots of the oil, in the aggregate about 18,000 gallons at prices varying from fifty five to seventy cents per gallon. During the year 1870 we have sold Yeomans & Goss about 3,000 gallons of the deodorized lubricating oil.

Int. 8. Please state what the sales of the Downer Company have been per annum since 1868, including that year, and what the article you have sold has been, for what uses it was purchased, and whether or not any of it, and if any, how much of it, has been exported to other countries during that period.

Ans. The sales of the Downer Company in 1868 were 276,222 gallons, and in 1869, 465,290 gallons; all of which was my deodorized hydrocarbon oil. Its uses have principally been for lubricating machinery, and
75 oiling wool, either alone or in combination with fatty oils. During the years 1868 and 1869 we sold for export to Great Britain 75,400 gallons, and to the continent of Europe about 133,000 gallons, or a total of 207,890 gallons.

Int. 9. If you have any knowledge of your own as to the character of the hydrocarbon lubricating oils in use abroad, prior to the period when the first exportation of your deodorized oil was made, please state what your means of knowledge on the subject were, and what are the facts.

Ans. I have a general knowledge of the manufacture and quality of hydrocarbon lubricating oils, particularly in Great Britain. I visited Europe in the summer of 1868, and in the month of July I visited many works in Scotland and Wales, where these oils were manufactured from coals and shales. The products produced there were, in character and quality, much like the paraffine oils produced in this country from petroleum, with the exception that they had rather more of the creosote odor, and were generally free from the property which we call polarization, or fluorescence, or did not possess, excepting in a slight degree, the green-and-blue shade which characterizes paraffine oils made from the residuums of petroleum. I visited most of the largest works, such as James Young's, at Bathgate, John Watson's Sons, at Bathville—these were

in Scotland—and several others in Wales, whose names I do not recall. I also saw many samples of oil in the offices of oil merchants, which they informed me were produced by British manufacturers, and which they used largely in their trade.

Int. 10. At that period were there any hydrocarbon lubricating oils in use, to any considerable extent, in Great Britain, so far as you learned, which were imported there from this country?

Ans. There were not.

Int. 11. Whether or not you carried with you, and exhibited to any consumers in Great Britain, specimens of the oil manufactured under your patent, and if so, with what result.

Ans. I did carry samples of my deodorized hydrocarbon oil, and in Manchester, England, I showed them to an oil merchant; Messrs. G. & R. Skelton was the name of the firm. He [at first disputed their being hydrocarbon oil, stating that he believed it to be a fatty oil, of a very neutral character, but upon examination and testing the oil for fatty oils, by using alkalies in combination with it, he was convinced
76 of its pure hydrocarbon character or purity, and] gave me an order for ten tons as a sample. Before the ten-ton order was shipped, he increased it to twenty tons, being three hundred and ten American gallons to the ton; and since that date we have sold him 58,000 gallons, [which he assures us is used for lubricating cotton and woollen machinery in the manufacturing districts of Great Britain.]

(The statements in brackets objected to by defendants' counsel.)

Int. 12. Please state when you first discovered that it was possible to separate the lighter hydrocarbon oils from the heavier, in such a manner as to deodorize the heavier oil; and if there were any peculiar circumstances which led to your investigations upon the subject, please to state what those circumstances were.

Ans. On the 29th day of November, 1867, I first had my attention called to the deodorized oil, which was occasioned by an accident happening to the distilling apparatus whilst performing distillation upon an oil known as No. 2 oil, which was an oil too heavy for illuminating purposes and too light for lubricating purposes, and was being distilled for the purpose of separating, in the usual manner, the heavy and light oils existing in the No. 2 oil. The still was loaded with the No. 2 oil and fired as usual, but after the oil began to run from the condenser it became evident that this condenser was partially closed, as a considerable pressure was created upon the still, so much so as to cause it to leak slightly at the bottom joint. The obstruction in the condenser seemed to increase the pressure, and we were obliged to slow down the fire, to relieve it. We continued the distillation with a slow fire, in hopes to run off the charge from the still, but the obstruction increased so much in the condenser as to necessitate the withdrawal of the fire from under the still to relieve the pressure, which was so great as to create quite a serious fire, from the leakage of oil down into the fire from the joint. The still contained, when first filled, about nine hundred gallons of the No. 2 oil. We had distilled over through the condenser about two hundred and fifty gallons at the time we were obliged to withdraw the fire. The next day, the 30th of November, the oil left in the still had cooled sufficiently to safely permit the removal of the manplate for the purpose of removing the oil from the still. I noticed that the oil remaining in the still was unlike any oil I ever before saw. It was of a good yellow color, very odorless, and neutral in smell and oily in
77 body; and I reasoned that the removal of the light oils that were in the No. 2 oil was one of the causes of its neutrality and freedom

from odor and increased body, and that the yellow color was due to the fact that we had been obliged to use a very moderate fire in distilling over the portion that had been distilled over. I saved samples of the oil, and showed them to members of our company, and they were as much impressed with the quality, in respect to the peculiarities mentioned, as myself. I began experimenting upon various heavy oils in my laboratory for the purpose of verifying my theory in regard to the neutrality and body of the oil, as found in the s ill, as described. I made many experiments, distilling mostly in glass retorts, during the month of December following, to ascertain the amount of distillate necessary to be removed to produce an article at once free from odor, oily in body, and of good color, distilling from our regular machinery or lubricating oil, various percentages, from ten to thirty, and with varying intensities of flame, from very slow to quite rapid. Having satisfied myself about the quantity necessary to be removed, I began distilling the oil in an iron still of a capacity of about fifty gallons. Having here larger quantities to work with, I began a series of experiments to ascertain the gravity of the oils distilling over from the lubricating oil, and what point of gravity it was necessary to reach to make an oil deodorized, and of good body and color. I ascertained that when I distilled off that portion of the oil which came over to the condenser, until the distillate reached the gravity of thirty-six degrees Beaumé, the oil remaining back in the distilling apparatus was so entirely changed in odor and body as to constitute a new article in the trade; it having only a slight smell, more like a sweet fatty oil, and entirely different from the characteristic odor of the paraffine oils, as before manufactured; but I found the oil was rendered more oleaginous, and in some respects improved, by continuing the distillation until the oil remaining from the condenser had a gravity of thirty-two degrees Beaumé. This occupied nearly the entire months of December and January. After ascertaining just what was required to produce my deodorized oil, I began its practical manufacture in a two hundred gallon still, and when a sufficient quantity had been made, offered it to the trade as an article of commerce.

Int. 13. Please state whether or not there was anything in your experience as a manufacturer of paraffine oils, or in that of other
78 manufacturers, so far as you are aware, or in what was known in chemistry concerning the class of substances to which these oils belong, which afforded any reason to believe that the odor which characterized them was contained in the more volatile constituent oils, and that certain of the heavy oils were inodorless in character.

(Objected to as leading.)

Ans. In my own experience as a manufacturer of hydrocarbon oils, I never have seen anything that would occasion the belief, or suggestion even, that the odors peculiar to heavy carbon oils, as made before my discovery, were due to the light, more volatile oils, with which they are associated, and in all my intercourse with other manufacturers of hydrocarbon oils, I never heard the subject alluded to in that connection; but I have always entertained a belief that the heavy hydrocarbon oils had a characteristic odor peculiar to themselves, which, like that of sperm, whale, or other fatty oils, might be readily distinguished and ascertained; but since my discovery, I know I can manufacture a heavy hydrocarbon oil as free from odor and taste as paraffine wax itself, and paraffine is as odorless as granite.

Int. 14. Since the Downer Company have been selling your new de-

odorized oil, have they made any sales of the old oil; and, if so, to what extent have they sold it?

Ans. They have made sales of the old oil. When we first began to sell the deodorized oil, it required a certain length of time to enable the dealers to become familiar with the article and its qualities, and during that period considerable of the old oil was in demand, and was sold; but during the year 1868 the sale of the old oil rapidly diminished, and but a small proportion of the oil sold was of that class of oils. At the present time we have two customers, who, for reasons best known to themselves, continue, to a certain extent, to purchase that oil, both of whom are located in the city of Providence, R. I.

Int. 15. Please state, if you can, the prices at which your new oil has been sold, and the prices during the same period, of the fatty oils, and of the ordinary paraffines.

Ans. The price of our new oil for the year 1868, was fifty cents a gallon to dealers, and sixty cents to actual consumers. During that time we produced only the article known as our bleached deodorized oil, its color being much like that of natural sperm oil. In 1869 the
79 price was fifty-five cents to the trade, and sixty cents to actual consumers for unbleached oil, and seventy cents to the trade, and seventy five cents to actual consumers for the bleached oil, the color of which was pale lemon, yellow, and very beautiful. Since about 1870 we have reduced the price of bleached oil to fifty-five cents to the trade, and sixty cents to consumers. The price of fatty oils in 1868 was, for sperm, about two dollars and seventy cents per gallon. In 1869, about one dollar and seventy-five cents per gallon, and at the present time, one dollar and twenty-five cents. Other fatty oils, like lard and whale, were comparatively high in price during this whole period, ranging from one dollar and twenty-five cents to one dollar and fifty cents for whale; and from one dollar to two dollars for lard, according to quality. The price of paraffine oils of the ordinary manufacture, since 1868, has ranged from twenty-five to forty cents per gallon.

Int. 16. Please state where, when, and under what circumstances you first saw Tweddle's topaz oil.

Ans. I first saw a sample of the oil at the office of the Downer Kerosene Oil Company in Boston, in about July, 1869, as near as my memory serves. It was handed me by Mr. David M. Yeomans, who was, at that time, a regular purchaser of our oils, and he wished particularly to call my attention to it.

Int. 17. If any conversation took place at that time with Mr. Yeomans with reference to Tweddle's oil, a sample of which, you say, he showed you, state, as nearly as you can recollect, what that conversation was.

Ans. There was conversation took place between us, and Mr. Yeomans told me that the oil more closely resembled mine than any oil he had ever seen, and that he believed it was an infringement of my patent, for I had often told him that I claimed a deodorized heavy hydrocarbon oil as a new product. He obtained for me and gave me a sample of the oil.

Int. 18. What did you do with the sample which you say he obtained for you and gave to you?

Ans. I subjected the sample to careful examination—first taking its specific gravity, then testing it on a friction test known as McNaught's machine, with a view to ascertain its body or oily character, and then distilled a sample of it in a glass retort to ascertain if any
80 thin, volatile oils were associated with it, and to what extent. I found, upon distillation, that the oil contained a small percentage

of a light-colored oil, but which was of an oily character when rubbed between the thumb and finger, and in that respect very like my own oil, and totally unlike the ordinary paraffine oils in the market. Its gravity was about thirty-four degrees Beaumé at sixty degrees Fahrenheit. It weighed eighteen degrees McNaught's test, when the ordinary paraffine oils weighed much less, my own oils testing by that instrument twenty-two degrees. In short, its general appearance and characteristics so closely resembled my deodorized oil that I was confirmed in my opinion of its being an infringement of my patents, and so informed Mr. Yeomans.

Adjourned.

THURSDAY, *Nov.* 3, 1870.

Int. 19. You have spoken in the preceding answer of McNaught's friction test. Please explain what that machine is designed to measure, and how it is constructed.

Ans. The design of the McNaught instrument is to test in a mechanical manner the body or viscidity of an oil. The construction of the machine consists in a disc of metal attached to a vertical spindle, the disc being made in a saucer shape, the saucer containing a few drops of oil, sufficient to cover, in a thin film, the entire surface of the plate. A smaller disc is made to fit accurately upon the top of the disc described, the surfaces of the two discs being kept slightly apart by means of an adjustable set-screw, placed upon the top of a small spindle or projection upon the upper disc. The projection is accurately drilled, so that it may be placed upon a spindle standing up from the lower disc. Upon the upper disc is placed a small pin, which, when the machine is in operation, comes in contact with the short arm of a lever or beam, the long arm of which is graduated into degrees, upon which is placed a sliding pea or weight. The lower disc is made to revolve preferably at six hundred revolutions per minute. The oil to be tested is placed in the cup of the lower disc, and the upper disc placed upon the oil, and by means of the screw so adjusted as to bear upon the oil itself, and not touch the metal. The revolution of the lower disc carries around with it the upper disc, until its small pin strikes the short arm of the
81 lever which holds the upper disc at rest, and the pea is then slid out on the long arm of the lever until the weight counterbalances the amount of friction exerted between the two plates. At whatever number it balances we call it testing so much McNaught.

Int. 20. Please state whether, since you tested with McNaught's instrument the sample of Tweddle's oil you have been speaking of, you repeated the same test upon other samples of the defendant's oil; and, if so, with what result.

Ans. I did repeat the experiment at various times with samples of Tweddle's oil, and with uniform results; in the main, like the one described.

Int 21. State whether or not you made any experiments in regard to mixing samples of the defendants' oil with fatty oils; and, if so, what were the results of those experiments.

Ans. I did make experiments, several times repeated, of the mixture of fatty oils with the Tweddle oil, and I found that a small quantity of fatty oil only was required, usually not exceeding one-quarter part, to give the odor and general characteristics of the fatty oil to the mixture; but I found that somewhat larger percentages of fatty oil were required to give a body or oleaginous character to the mixture than was the case when using my oil.

Int. 22. Do you know, from your connection with the business of the Downer Company, whether or not any considerable amount of your deodorized oil is used for lubricating purposes in a pure form?

Ans. It has been our practice to invariably sell the oils in their pure state, and many of our customers use the oil for lubrication without admixture.

Int. 23. State in what proportions your deodorized oil can be mixed with fatty oils, so as to partake of the character of the fatty oils.

Ans. When mixed with sperm, whale, or olive oils, in the proportion of twenty parts of those oils to eighty parts of the deodorized oil, it has the character, and taste, and general character of those oils. Mixed with lard or cotton-seed oils, a somewhat larger proportion of those oils are required, on account of their almost entire freedom from odor, to give their general character to the mixture. About one-third of those oils to two-thirds of the deodorized oil is required to give their general character to the mixture.

82 Int. 24. State whether or not you have recently made any arrangement with parties in Great Britain for the manufacture of your oil there; and, if so, what is the general character of those arrangements.

(Objected to as incompetent and immaterial.)

Ans. I have made an arrangement with a large manufacturing firm in Glasgow, Scotland, for the manufacture of my deodorized oil under my patents in Great Britain, whereby they agree to manufacture the deodorized oil and pay me a royalty upon all such oil manufactured and sold by them; and until such time as they can produce the oil at their own works I agree to supply them with the deodorized oil of our own manufacture from this country.

Int. 25. Please state, if you can do so, the price of the various fatty lubricating oils during the latter part of the year 1865, at which period you have stated the price of the paraffine oil you then produced was eighty cents.

Ans. As near as my memory serves me, the sperm oil varied in price during that year from two dollars and fifty cents to three dollars per gallon. The price of lard was from one dollar and ten to one dollar sixty cents per gallon; whale oil, one dollar to one dollar and thirty cents per gallon; olive oil, from two dollars to two dollars and fifty cents per gallon.

Int. 26. State whether or not you purchased at any time for the Downer Co. a barrel of the defendants' oil. If so, state when, from whom you purchased it, and what you did with it after you bought it.

Ans. I did purchase a barrel of neutral topaz oil in February or March, 1870. I purchased it of Smith & Merrill, and it is now in the possession of the Downer Kerosene Oil Company, at their works in South Boston.

Int. 27. State where it has been during the interval since you purchased it, and what mark the barrel bears.

Ans. It has been stored in the cellar of the Downer Oil Works, at South Boston, where it was placed at the time of purchase. There is a stencil or brand upon the head of the barrel, as follows: "Eclipse Neutral Topaz Oil, manufactnred by Herbert W. C. Tweddle, under his patents, Pittsburg, Penn." On the other head is stencilled, "J. R. Bartlett, Boston."

83 Int. 28. Whether or not any portions of the contents of that barrel have been at any time taken out by you, or in your presence; and, if so, to whom, and where such portions were delivered?

Ans. There have been samples taken from the barrel in the presence

of various people. Dr. S. Dana Hayes received a sample of it, also Professor B. Silliman, and Professor Chandler of New York; and I also took a sample in presence of Mr. John Dunlap, one of the employees of the Downer Company, wh ch sample I gave to Mr. Walter Curtis.

Int. 29. Will you please describe what you understand to have been the usual method of treating and means employed in the treatment of the crude material, when the manufacturer designed to produce from that material a burning oil?

Ans. The treatment of petroleum for the production of burning oil, as generally practised, is to place the petroleum in the distilling-apparatus, and, by the application of heat, to first distil off the naphtha down to about sixty degrees Beaumé at sixty degrees Fahrenheit. At this point, the stream of oil running from the condenser is changed into another tank, and the distillation continued, until the oil coming over changes in color from a white, or nearly white, shade to a slightly yellowish tint, and the gravity of the oil reaches a density of about forty Beaumé at sixty degrees Fahrenheit. At this stage the fires under the still are damped, and the distillation conducted more slowly, guided by the character of the oil running from the condenser; the object being to maintain the flow of oil from the still at a gravity of not heavier than forty Beaumé, and of as light a color as possible. As the distillation proceeds, the fires have to be gradually reduced in strength, and the oil flowing from the condenser much diminished in volume, in comparison to that where the body of the burning oil was being distilled and before the gravity had reached forty Beaumé. The quantity usual to distil from a distillery vessel of the capacity of five hundred barrels, before the gravity reaches forty Beaumé, is from ten to twelve hundred gallons per hour. After the gravity reaches forty Beaumé, the distillation is so reduced in volume that about two hundred gallons per hour is distilled over, and as the still draws near the finish of the charge, the stream running from the condenser is still further reduced to
84 about one hundred gallons per hour. This is the process known as cracking, which, when practised, converts the whole of the heavy portions of the petroleum into a light gravity and thin burning oil. It is generally the practice to leave in the distilling-vessel from three to ten per cent. of a heavy residuum, often varied at the will of the operator. The residuum is frequently distilled in smaller distilling-vessels, and the distillate mixed again with the crude oil, to again go through the same treatment as above described. To purify and bleach the burning oil, it is the practice to treat it with from two to four ounces of sulphuric acid to the gallon of oil, and, after washing with water, to remove the excess of acid held in suspension in the oil; it is then treated with a solution of caustic alkali, and, when settled bright and clean, it is the product known as refined petroleum, or burning oil.

Int. 30. Please describe the method of treatment, and the means employed by the Downer Company in producing lubricating oil, prior to the period when they began to manufacture your new deodorized lubricating oil, and point out any differences between the method pursued by them and that of other manufacturers in producing lubricating oil; and, if you are aware of any variation in the means resorted to by other manufacturers in carrying on the process, please state what variations in the apparatus you have known to have been made.

Ans. It has been the practice at the works of the Downer Company, in distilling petroleum, prior to the date of my discovery of my deodorized oil, as follows: The crude petroleum is placed in a still of the capacity of about three hundred barrels, and, by means of a steam-coil

placed within the still, through which a circulation of steam is maintained, we proceed to remove by distillation, effected by the steam heat, that portion of the crude petroleum known as naphtha, running into separate tanks the naphtha portion, until the gravity reaches sixty degrees Beaumé at sixty Fahrenheit. At this stage of the distillation, the steam is shut off from the coils, and the crude petroleum from which the naphtha has been removed is pumped into stills of a capacity of one thousand gallons, the stills being so arranged that a fire may be placed underneath, and a circular flue, set in brick, extend around the sides of the still to within a few inches of the top. We proceed in the fire-stills to continue the distillation of the crude petroleum, which will be at the commencement a burning oil of a gravity heavier than sixty degrees Beaumé, and the distillation is continued until the oil
85 running from the condenser has a gravity of thirty-six degrees Beaumé, at sixty Fahrenheit. That portion of the oil distilling over, between sixty and thirty-six degrees, constitutes the burning-oil, which is run into separate tanks by itself. Without diminishing the fire, or slowing the distillation, we proceed to distill in a rapid manner, and, with as little breaking up or cracking of the heavier oils as possible, continue the distillation, until the oil becomes too foul, or objectionable in its character, to be saved for lubricating oil. That portion of the distillate which comes over, after the oil is no longer fit to save for lubricating oil, is run into a tank by itself, and the still run to dryness, or coke. The portion last described, when sufficiently accumulated, is again distilled in a rapid manner, and that portion of the distillate which weighs heavier than thirty-six degrees Beaumé, and is sufficiently good in color, is run in with the lubricating oil first distilled from the crude petroleum direct, as described. The object of this method of distillation is directly the reverse of that at first described as the cracking process. In the last described process, a very large amount of lubricating oil is produced from crude petroleum, varying somewhat, according to the character and gravity of the crude petroleum used, but generally equalling about twenty to twenty-five per cent. of lubricating oil, from the crude petroleum. The burning-oil portion, before alluded to and manufactured by this process, is first treated with four ounces of sulphuric acid to the gallon of oil, and after careful washing with water, to remove the excess of acid held in suspension in the oil, it is treated with a solution of caustic alkali, to neutralize all remaining traces of acid. After this treatment, the burning-oil is again distilled and separated into its various gravity oils, but the main portion of the distillate consists of burning-oil. When the gravity reaches thirty-six degrees Beaumé, at sixty degrees Fahrenheit, the oil flowing from the condenser in this distillation is run into the lubricating-oil tank, until in color it is no longer suitable to be saved for lubricating oil; at which stage the offensive dark-colored oil is permitted to flow into the separate tank before mentioned. The lubricating portion of the oil distilled from the crude petroleum, below thirty-six degrees Beaumé, is sometimes chilled, by the use of ice, to a temperature sufficiently low to crystallize the main portion of the paraffine it contains in solution.
86 After the chilling and pressing, the oil is subjected to a treatment of acid and alkali, to, in a measure, remove the offensive odors, with which it is associated or combined, in which condition, when thoroughly bright and clear, it is ready for sale as a lubricating oil. The lubricating oil as described by this process was known as machinery oil, and sold under that brand. To manufacture a still finer quality of lubricating oil, it was our practice, before chilling and pressing the once

distilled heavy oil, made from the crude petroleum, to first treat the oil with acids and alkalies, and then to distil the oil the second time, dividing, as at first, all the oil that came over above thirty-six Beaumé into burning-oil, and all that came over below thirty-six Beaumé into lubricating oil, and this oil so treated, after chilling and removing the paraffine from it, was of a very beautiful light lemon-color, and sold under the brand of spindle oil. Other manufacturers of lubricating oils usually employ the tarry residuum for the purpose of producing, by distillation from it, a paraffine lubricating oil. The tarry residuum referred to is the product from a distillation of crude petroleum, where the cracking process, before referred to, has broken up or changed the heavy oils, which exist in crude petroleum, into thin burning-oils, leaving a comparatively small percentage of paraffine oils in the residuum. The use of acids and alkalies is resorted to to purify the lubricating oil made from the residuum and improve its color and smell. It is the usual practice to treat those oils with acids and alkalies before the paraffine is removed from the oil. We have used various kinds of distilling vessels in manufacturing lubricating oil, and a great variety of forms have been used by the Downer Co., and by others, for that purpose. It is sometimes the practice, during the distillation of the lubricating oils, to admit steam as it comes from the boiler, superheated, into the body of the oil in the still, during the process of distillation. I have also long known that distillation has been performed with the aid of steam and a vacuum, or partial vacuum, in the distilling vessel, during the distillation.

Int. 31. State what was the method usually employed by the manufacturers to obtain from the crude petroleum paraffine.

Ans. The usual and only method that I know of for producing paraffine from crude petroleum, with the single exception of that petroleum known as the Rangoon or Burmese petroleum, is to first distil the crude petroleum and separate the distillates into thin burning-oils, which
87 contain very little paraffine, and into heavy or lubricating oils, which contain very large percentages of paraffine, the paraffine, after distillation of the crude petroleum, arranging itself into the crystalline structure or form, on the reduction of temperature sufficient to crystallize it from its solution in the oil.

Int. 32. State what was the character of the lubricating oil produced by the Downer Company by the process you have just described, in regard to odor and body; and whether or not any efforts were made by you during the period prior to your discovery of the deodorized oil to improve the quality of the lubricating oil then manufactured in these respects.

Ans. The lubricating oil manufactured by the Downer Company, prior to the discovery of the deodorized oil, was of an excellent character as regarded odor and body, in view of the state of the art at that time. The machinery oil was of a heavy body, having a gravity of about thirty degrees Beaumé, and what we termed a pleasant odor, or not particularly offensive odor, but was somewhat dark in color. The spindle oil had still less odor, and was lighter in gravity, being about thirty-two degrees Beaumé. It was of a very beautiful color, but the odor that the oils possessed, when smelt of in tank or small vessel, was not particularly objectionable, having the characteristic smell of petroleum products. We had more or less complaint of them, when used in close rooms like cotton or woollen factories, on account of a pervading odor they gave to the whole room. Complaints were also made by the consumers that the oil flew from the bearings when applied to machin-

ery under rapid motion, and it seemed to lack the body requisite to lubricate machinery under rapid motion in warm rooms. I made many attempts to improve the body and remove the characteristic odor of the lubricating oils, the improvement in body being mainly improved, or attempted to be improved, by distilling in shallow stills, perfectly protected from radiation of heat, and by the use of steam during the distillation, to prevent as much as possible the breaking up of the oil into lighter-bodied oils. To improve the odor of the oils, I resorted to the use of various chemical agents, for the purpose of changing or oxidizing the odor of the oil, or of the bodies which produced the odor, in my judgment, using chromic acid, sulphuric acid, and, in some cases, small portions of nitric acid, for the purpose of deodorization, and so
88 far succeeded as to produce an oil with a slight odor as was possible, by chemical treatment, in my judgment. I performed many experiments of distilling oil in combination with alkaline bases, such as sodium and potassium, for the purpose of thoroughly removing any sulphur compounds that might exist in the oil and affect its odor. I did not meet with success in following that line of treatment.

Int. 33. Please state to what extent these oils were used by your customers, in pure form, if at all, for lubricating machinery, and in what proportions they were mixed with fatty oils for the same purpose.

Ans. The oils were used to a very limited extent in a pure state, for lubricating machinery, but generally were compounded in varying proportions, from one-third fatty oils, to two-thirds paraffine oils, and inversely two-thirds fatty oils, and one-third paraffine oil, according to the judgment of the consumer.

Int. 34. How did these oils compare in quality with those produced by the Portland Oil Company, if you know?

Ans. They were made by the same processes, and substantially were alike.

Int. 35. State whether in manufacturing your new deodorized oil you subject it to treatment with acids and alkalies.

Ans. I do sometimes so treat the oil, and sometimes treat it without acids and alkalies. I do not confine myself to any particular mode of treatment chemically. An odorless and very beautiful oil can be made by my process without the use of acids in any form.

Adjourned.

FRIDAY, *Nov.* 4, 1870.

Int. 36. State whether or not you make your new deodorized oil both bleached and unbleached.

Ans. I do make it of both kinds.

Int. 37. Please state, somewhat more specifically than you have already stated, the objections made by persons who have purchased your old oil for use in cotton manufactories.

Ans. I stated in answer to a previous question that we had many complaints of a volatile pervading odor in the rooms where the oil was used, and in addition to that we had complaints that the oil had
89 a tendency to coat the windows to a degree sufficient to seriously obscure the light; and we had samples of that material in one instance scraped from the windows of a cotton factory—as near as I can remember it was the Boott Mills, in Lowell—and had it subjected to a chemical analysis by Dr. A. A. Hayes, of Boston, who stated that he found it to consist, principally, of hydrocarbon matter and dust, which had hardened under the influence of the sun's rays and of diffused light, upon the windows. We found it more generally coated the win-

dows in those rooms where rapid-moving machinery was used, such as throstle and mule spinning rooms, where the mechanical action in rapid motion either produced more vaporization from the oil, or mechanically threw the oil in a finer divided state against the glass. I found upon careful inquiry that sometimes when only sperm oil was used, a very slight deposit was occasioned upon the glass, but in those cases it was easily removed by wiping with waste or cloth.

Int. 38. What have been the facts in this respect since you sold your new oil?

Ans. I never have heard a complaint of the coating of the windows when our new oil has been used.

Int. 39. You have stated in your answer to the thirty-first interrogatory that various forms of apparatus have been introduced in carrying on the process of distillation of hydrocarbon oils, and have mentioned the admission of steam and the use of a vacuum or partial vacuum in the distilling vessel. Please state from what source your knowledge in this respect is derived, independently of your own observation; and if you are aware of any descriptions of such apparatus, state where they are to be found.

Ans. I have for a long time known that a great variety of apparatus, aside from which I myself have used, has been used for distilling hydrocarbon oils and other substances; and I have a little memorandum of English patents relating to that class of distillations, which I will enumerate: Nov. 25, 1844, numbered 10,406, William Oxley, English patented distilling apparatus for the purpose of distilling turpentine and tar by withdrawing atmospheric pressure from the distilling apparatus by means of an air-pump; Dec. 15, 1847, numbered 11,995, David Williams, wire-distilling resin in combination with fats, in a vacuum,
90 and with the use of highly-heated steam; March 14, 1849, numbered 12,512, George Ferguson Wilson, distilling out of the atmosphere by the use of highly-heated steam, and distilling paraffine in a similar manner; Nov. 2, 1849, numbered 12,827, Charles Cooper, distilling naphtha or other products from coal by introducing steam and using a pump to create a vacuum. Then, in this country, M. P. Ewing, Sept. 11, 1866, No. 58,020, distilling off the light ends from crude petroleum, in a vacuum, by the use of steam or its equivalent; and the patent which I own, issued to H. B. Everest, Feb. 23, 1869, No. 87,157, removing the thin and objectionable oils from the heavy oils distilled from petroleum by means of superheated steam and a vacuum.

Int. 40. State what the exhibits now shown you are samples of, and where they were obtained; and if you purchased any of them, state the prices at which they were purchased.

Ans. Exhibit No. 2 is a sample of paraffine oil manufactured by Libby & Clark, Maiden Lane, New York, and bought April 2, 1870, of Davis & Derby, No. 124 Maiden Lane, New York City; price forty-five cents per gallon. Exhibit No. 3 is a sample of oil made by Richardson, of New York, and bought by Charles S. Potter, and by him purchased direct from the manufacturers, April 4, 1870, at the price of forty cents per gallon. Exhibit No. 4 is a paraffine oil manufactured by Merriam & Morgan, of Cleveland, Ohio, and bought of Derby & Co., John street, New York, April 2, 1870, at the price of fifty-two cents per gallon. Exhibit No. 5 is a sample of Seccomb's brilliant paraffine oil, obtained from Mr. Francis Maguire, of Boston, and given to him, as he told me, by Mr. Thayer, of the firm of Seccomb, Kehoe & Thayer. I obtained the sample about ten days ago. Exhibit No. 6 is a sample of paraffine oil manufactured by William Lincoln, of Boston, obtained from Smith & Mer-

rill, at the price of thirty-five cents per gallon. Exhibit No. 7 is a sample of oil made by Coffin, of Boston, obtained from Joseph Harris, of Boston, his agent, Nov. 2, 1870, at a price of forty cents per gallon. Exhibit No. 8 is a sample of paraffine oil manufactured by Reed, of East Boston, obtained from Smith & Merrill, in the spring of 1870, at forty cents per gallon. Exhibit No. 9 is a sample of paraffine oil made by the Downer Kerosene Oil Company, under the brand of machinery-oil before 1868, made by our old process. The price of the oil was fifty cents per gallon. Exhibit No. 10 is a sample of paraffine oil manufactured
91 by the Downer Kerosene Oil Company, and is such as was sold by them prior to 1868, made by the old process, and sold as spindle oil, at price of sixty cents per gallon. Exhibit No. 11 is a sample of Merrill's deodorized heavy hydrocarbon oil, made under his patent, and sold as unbleached oil at fifty-five cents per gallon. Exhibit No. 12 is a sample of Merrill's deodorized heavy hydrocarbon oil, as made by his patent, and sold as bleached oil, or light 29 sometimes called, price sixty cents per gallon Exhibit No. 13 is a sample of Tweddle's neutral Topaz oil, taken from the barrel Nov. 2, 1870. The barrel was purchased of Smith & Merrill in February or March, 1870, price sixty-five cents. The prices I have given were retail prices of Exhibits Nos. 2, 3, and 4, and the wholesale prices of the other exhibits. The prices given of our own oils were prices in 1866 and 1867, excepting those of oils made under Merrill's patent, which are the present prices.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. You have described certain operations at the Downer Kerosene Works on the 29th and 30th of November, 1867, which were the occasion of your making the discovery said to have been patented in this case. Referring to that narrative, will you tell us what was the oil known as No. 2 oil, upon which you were performing distillation? Was it the oil which remained in the still after the burning oil had been distilled off?

Ans. It was the practice at the works of the Downer Kerosene Oil Company, prior to the discovery, to crack a considerable portion of the heavy oils which distilled over from the petroleum oils, for the purpose of making them into burning oils, and we usually cracked the heavy oil after the first distillation of the crude petroleum, by itself, separately; that is, filling a still full of the heavy oil which was separated in the first distillation of crude petroleum. This cracked heavy oil was treated chemically, and redistilled for the purpose of separating from it, by distillation, that portion of the oil which was cracked sufficiently fine to be suitable for burning oil; and when such oils were so separated, the distillation was continued, and after the burning oil there came a product that was too light for machinery oil and too heavy for burning oil. This oil we called No. 2 oil, for convenience, and it was that oil we were operating upon at the time when the discovery was made.

92 Cross-int. 2. This No. 2 oil, you say, was being distilled for the purpose of separating, in the usual manner, the heavy and light oils existing in it. Do you mean that the light oils were to be distilled off first for burning oil, and the heavy oil next for lubricating oil?

Ans. The No. 2 oil was a favorite stock from which to manufacture lubricating oil, because it had already been treated with chemicals, and distilled, and was of a very beautiful color, and it was our practice to make our spindle oils from that class of oil, and in this case we were distilling the No. 2 oil for the purpose named, separating by distillation, as perfectly as possible, the thin oils from the more fixed and heavy oils existing in it.

Cross-int. 3. Were you going to distil off the thin oils, and then to distil off the heavy oils, or was the heavy oil to be left in the still?

Ans. We were going to distil off the thin oils, then the heavy oils, and run the still to coke.

Cross-int. 4. This was an operation which was a familiar or customary one in that establishment previously to and at this time, was it?

Ans. Yes, sir, it was in daily practice.

Cross int. 5. You had found up to this time, if I understand you, that when the heavy oils came over from the still, in pursuing this operation, they had associated with them some compounds of an offensive odor?

Ans. They invariably did.

Cross-int. 6. When it appeared that the heavy oil remaining in the still, after being subjected to the low and slow heat which the accident that had happened to the condenser rendered necessary, as you have described, did this show that the cause of the production of such offensive compounds in the heavy oil was the greater heat to which you had been accustomed to subject it?

Ans. In this case the still was at first fired as was usual, we having no intimation that anything was the matter with the condenser until the still began to run oil quite rapidly, and the stoppage in the condenser we afterwards discovered was occasioned by a piece of charcoal which had accidentally got into the coil, while undergoing repairs, and had worked its way down from the larger part to the smaller part of the coil slowly, or not suddenly. When it finally reached a place so small as to nearly close the opening a considerable portion of the oil had
93 distilled over, probably not less than one hundred and fifty gallons, when it became necessary to damp the fire, and finally necessary to withdraw it altogether. During the latter portion of the time the fire-door was open, and the fire constantly diminishing. I think that the heat applied to oil, for the purpose of distilling it in the ordinary manner, is not sufficiently high to produce offensive odors in that portion of the oil left back in the distilling apparatus; but when fired strongly, and distillation is very rapidly performed, the oil in the still usually grows dark in color, somewhat in proportion to the intensity of the heat applied.

Cross-int. 7. When it appeared that the heavy oil remaining in the still, after being subjected to the low and slow heat which this accident had rendered necessary, was free from the offensive odor which you say invariably accompanied the heavy oils when they came over from the still, did this show you that the cause of the production of the offensive compounds in the heavy oils was the greater heat to which, in your previous practice, you had been accustomed to subject the heavy oil, for the purpose of distilling it over into the condenser?

Ans. No, sir; I should think not, for the reason that the oil in the still to which the accident happened had reached a temperature of at least six hundred degrees Fahrenheit before it became necessary to remove the fire from under the still; and there was nothing in the nature of the accident to build such a theory upon.

Cross-int. 8. I find in the specification of your patent the following statement: "I suppose that these odors arise from matters resulting from decomposition, at the temperature at which the heavy oils vaporize and go over, and that these matters after they are condensed with the heavy oils will vaporize at a temperature lower than that required to vaporize and distil over the heavy oils." What led you to entertain that opinion at the time of executing your specification; if it was not the occurrences, before mentioned, of the 29th and 30th of November, 1867, what was it?

Ans. If you will refer to the specification, in a sentence just prior to the one quoted you will find these words: "I do not assume to know the reason why the above-described process produces heavy oils, free from the characteristic odors of hydrocarbon oils, but suppose, etc.," as stated in your interrogatory; but I have the same opinion now as when the specification was prepared, that at the actual point
94 of distillation, when the heavy oils arise in vapor they do undergo a partial change, and some of the products that go over to the condenser unite with the heavy oil, which products are of an offensive odor, and give their characteristic smell to the whole product, but I find that in actual practice those objectionable odors and bodies are capable of separation and distillation by a variety of means of applying heat, leaving the oil in the still comparatively odorless, or with a slight smell like sweet, fatty oil.

Cross-int. 9. Please to explain what that partial change is which you think the heavy oils undergo when they arise in vapor.

Ans. I think a portion of the oil is changed from a heavy, oleaginous character to an oil lighter in gravity and thinner in body than the heavy oil from which it is distilled.

Cross-int. 10. Is this change attended by a discoloration of that which remains in the still?

Ans. Usually there is more or less discoloration of the body remaining. In some cases it is very slight, in others quite marked.

Cross int. 11. Does this change consist in a secretion of parts of the carbon in the oil affected by the change?

Ans. I think not, but rather due to a slight scorching or burning of the oil in the distilling vessel.

Cross-int. 12. Would this burning or scorching, if carried sufficiently far, result in the production of coke in the bottom of the still?

Ans. I never have seen a lubricating oil distilled to dryness by any method of distillation, however conducted, but what more or less coke resulted from the distillation.

Cross-int. 13. Am I to understand that you mean to answer the last question affirmatively?

Ans. I do not think the burning or scorching would be the cause, or the sole cause, of the deposition of coke in the bottom of the distilling vessel, but mean merely to state as a matter of fact, in my own experience in distilling heavy lubricating oils, that coke is always found in the still as a residuary product when run to dryness.

Cross-int. 14. Is this burning or scorching of the heavy oil attended by the evolution of a permanent gas?

Ans. It is not attended by the evolution of a permanent gas until the distillation is far advanced, except it may be in very minute
95 quantities, scarcely perceptible. I would state that in removing the light oils, as practised by me to make my deodorized hydrocarbon oil, I have never observed the escape of permanent gases in any degree, but the heat applied to the oil in the still does produce a slight discoloration or scorching, much like that in the case of fatty oils, as sperm or lard, when heated to nearly their boiling points; but such pyrogenic colors or compounds readily yield to chemical treatment, as in the case of my bleached heavy deodorized hydrocabon oil, which is merely the unbleached oil chemically treated.

Cross-int. 15. What were the light oils which were associated with the heavy oil in the No. 2 oil you have spoken of?

Ans. The light oils were of a varying character, as distilled over from the No. 2 oil, usually ranging in gravity from as light as forty-five de-

grees Beaumé down to thirty-six degrees Beaumé, at which point we changed into lubricating oil. A considerable portion of the oil was light enough to go directly to burning oil, a portion of it was too heavy in body for burning oil, and it was our practice to run a portion of that oil into No. 2 oil, to be again subjected to precisely the same process of distillation that the No. 2 oil spoken of previously was subjected to.

Cross-int. 16. Why had not these light oils vaporized, at the temperature to which the No. 2 oil had been subjected, before you began to operate upon it?

Ans. In the distillation of the oil the vapors of the heavy oils are to a great degree soluble in those of the lighter oils, and it is a matter of great difficulty to make perfect separation of those oils from the heavier oils, or the heavier oils from the lighter oils; and I never saw an oil (before my own heavy deodorized oil was made) but what would, upon the application of distilling temperature, distil over a considerable portion of thin oil of light gravity and body many degrees above the gravity at which the heavy oil was divided when manufactured.

Cross-int. 17. What was the specific gravity of the No. 2 oil when you began to separate from it the lighter oils?

Ans. I do not remember the exact gravity of the No. 2 oil, but it usually embraced that portion of the distillate of the cracked oil before alluded to, between thirty-eight and thirty-five or thirty-six degrees Beaumé; sometimes running as low as thirty-five.

96 Cross-int. 18. Was this No. 2 refined oil a market article for any purpose? If so, what?

Ans. It was not; it was never sold in that form. It was merely a division of the oil in our method of working.

Cross-int. 19. In your answer to the thirtieth direct interrogatory, describing the process of making lubricating oil at the Downer Company's Works before the time of your discovery, you say: "After the chilling and pressing, the oil is subjected to a treatment of acid and alkali, to in a measure remove the offensive odors with which it is associated or combined." Do you here refer to the same offensive odor which you spoke of in your answer to the fifth cross-interrogatory, as the odor of compounds which were associated with heavy oils when they came over from the still?

Ans. I do.

Cross-int. 20. Do you refer to the same offensive odors which you say in your patent that you supposed to arise from matters resulting from decomposition at the temperature at which the heavy oils vaporize and go over?

Ans. I do not; and I will explain that those odors first alluded to are what we term a still-smell, and the treatment by chemicals removes in a great measure that particular class of odors, and changes the bodies formed in the still, which pass over with the heavy oil, [and alluded to in my patent, into what I term the characteristic odors of hydrocarbon oils.]

(Closing passage in brackets objected to as irresponsive and incompetent.)

Cross-int. 21. Speaking of the compounds of offensive odor which come over with the heavy oils from the still, as mentioned in the answer to the fifth cross-interrogatory, will you state between what temperatures these compounds are produced?

Ans. I cannot state the exact temperatures. In the ordinary distillation it was undoubtedly above six hundred Fahrenheit, but when steam is used in combination with the ordinary distillation, owing to its me-

chanical action of carrying over the vapors, it may take place at temperatures below six hundred.

Cross-int. 22. What was there left in the still when the No. 2 oil was distilled from it?

97 Ans. A heavy oil.

Cross-int. 23. If you take the heavy hydrocarbon oil which you speak of in your patent as having the offensive odors which you design to remove, can you produce from it lubricating oil as a distillate; that is to say, by converting heavy hydrocarbon oil into vapor which passes into the condenser, to be there condensed into oil?

Ans. Yes, sir.

Cross-int. 24. Will such lubricating oil, so produced as a distillate, retain the offensive odors in question?

Ans. Without further treatment it will.

Cross-int. 25. In this condition, without any further treatment, would it be a similar article to your patent deodorized lubricating oil?

Ans. It certainly would not.

Cross-int. 26. If from crude petroleum the naphthas be removed by distillation, and afterwards the burning oils be removed by distillation, will the oil which remains be the heavy hydrocarbon oil to the treatment of which your invention relates?

Ans. It would not, because to produce my oil it is necessary to distil that portion which you have spoken of in order to remove the tarry matter embodied in it, and to develop the paraffine in a crystalline form, or that may be made to assume a crystalline form upon reduction of temperature, so that it may be separated or removed from the oil.

Cross-int. 27. Do you know by what process Dr. Tweddle's lubricating oil, which the defendants in this case are complained for selling, is made?

Ans. I do, if he follows his patent, which I have reason to presume he does.

Cross-int. 28. You say that your oil is a new article as respects body, color, and odor. Are these the only respects in which it is a new article as compared with the lubricating oil produced by the Downer Kerosene Company just before your alleged discovery?

Ans. These are not the only respects in which it is a new article, and the only difference other than those mentioned is in its comparative freedom from the property I call polarization, or the power which the oils just prior to the manufacture of the deodorized oil, as made by the Downer Company and other paraffine oil-makers, possessed in a greater or less degree, some of them very marked. I refer to the green and

98 blue shade which those oils had when subjected to rays of reflected light, but in this respect the oils made from Albert coal, Breckenridge coal, Bog-Head coal, and the shales generally, possessed so slight polarized properties as to be hardly an objection in their use.

Cross-int. 29. What is the objection, in the use of a lubricating oil, to its possessing the property of polarization?

Ans. I never heard of any objection to it, excepting on the part of those people who mix the oil with higher-cost fatty oils, and would like to deceive the parties to whom the oil is sold, making them believe it to be a pure fatty oil. I never heard a complaint from an actual consumer of the article who purchased it for what it was.

(Adjourned.)

SATURDAY, *Nov.* 5, 1870.

Cross-int. 30. Are the body, color, odor, and freedom from polarization the only respects in which your lubricating oil is a new article as

compared with the lubricating oil produced by the Downer Kerosene Company just before your alleged discovery?

Ans. That is all I claim as new in the oil manufactured by me.

Cross-int. 31. Did the said Downer lubricating oil differ materially from yours in the matter of color?

Ans. Do you mean by color the actual color of the body of the oil, or that quality called fluorescence or polarization?

Cross-int. 32. I mean the actual color of the body of the oil.

Ans. It did not materially differ.

Cross-int. 33. Did it differ materially from your patent lubricating oil in body?

Ans. It did materially differ.

Cross-int. 34. How is the difference to be stated—in gravity? If otherwise, how otherwise?

Ans. It did not differ so much in gravity, but in the peculiar oleaginous property which the oil as made by my patent possessed, which enabled it to lubricate machinery perfectly in its pure, unmixed forms.

Cross-int. 35. Is this oleaginous property what is commonly called viscidity?

Ans. As I understand the meaning of the term viscidity, when applied to an oil, it means that particular quality which enables the
99 oil to retain its oleaginous body at a considerable elevation of temperature. My oil possesses that property in marked contrast to the ordinary paraffine oils as made before my discovery, and in that respect closely resembles sperm oil. Viscidity as applied to tar and molasses merely means thick, or possessing slight mobility.

Cross-int. 36. If I understand you, you mean, then, by the oleaginous property mentioned in the thirty-fourth cross-interrogatory, something different from viscidity as defined by you?

Ans. I mean body and viscidity, as applied to lubricating oils. Tenacity might also be a good expression to use in describing the oil; that is, that it possesses body, or requisite viscidity, and tenacity. By the latter term I mean endurance, when applied to machinery for the purpose of lubrication.

Cross-int. 37. When you use the word tenacity, meaning endurance, when applied to machinery for purposes of lubrication, do you mean that it is not easily displaced from the bearing by running off, flying off, or contact with rubbing surfaces?

Ans. I mean by the term, as applied to my oil, the peculiar power the oil possesses, that of lubricating machinery for a great length of time with one application, and its power of keeping rubbing surfaces of metal apart and well lubricated, so that the minimum of friction or resistance to the motor is secured and yet perfect lubrication accomplished.

Cross-int. 38. Do you mean substantially yes to my previous question, or do you mean something else?

Ans. I mean that it is not easily displaced by either of the causes named, in comparison to other paraffine oils manufactured prior to my discovery.

Cross-int. 39. Is there any property which you include under the term body that is not embraced in the terms tenacity and viscidity, applied to lubricating oil, as you have defined them?

Ans. There is a difference, and a very marked one. Some oils used for lubricating purposes possess body, or appear thick when shaken in a bottle, which do not possess the quality I mean by the word tenacity or endurance; and such oil , hen slightly elevated in temperature,

grow thin in body, and do not answer a good purpose in lubricating machinery.

100 Cross-int. 40. I think you have not answered my question. Will you listen to it again, and answer it, if you can, more directly?

(The question having been reread to the witness, he answers as follows:)

Ans. I intended to answer fully and freely in every particular the question.

Cross-int. 41. You have spoken of your oil as possessing the quality of tenacity, by which it resists displacement from the lubricated bearing, either by the force of gravity, or by centrifugal force, or the force of friction of surfaces. You have also spoken of it as possessing the quality of viscidity, meaning that notwithstanding a considerable elevation of temperature it retains its oleaginous body. Now I want to know what you mean by this "oleaginous body."

Ans. I mean by the oleaginous body, that property of a lubricating oil which is requisite to perfectly lubricate machinery. Water possesses a body; burning oil possesses a body, and various oils possess various bodies or degrees of thickness. I mean by body, in answer to the question, consistency.

Cross-int. 42. Which of these three properties, viscidity, tenacity, and consistency, is measured as to its degree, if either of them is, by the rate of gravity, specific or Beaumé?

Ans. Neither of them.

Cross-int. 43. What is the property of a lubricating oil which causes it to measure a greater or less gravity, specific or Beaumé.

Ans. Undoubtedly, carbonization.

Cross-int. 44. And what is that?

Ans. What I mean by carbonization is that hydrocarbon oils, in the process of their manufacture, arrange themselves, during the process of distillation, into various compounds of carbon and hydrogen, some being much more highly carbonized than others; and we invariably find those oils containing the largest proportions of carbon to be the heaviest in gravity.

Cross-int. 45. As regards the qualities of consistency, tenacity, and viscidity, which you have attributed to your patent lubricating oil, did the lubricating oil which the Downer Kerosene Company made just previous to your discovery differ materially from your patent lubricating oil?

Ans. They did differ very materially.

101 Cross-int. 46. To what do you attribute this difference in the consistency, tenacity, and viscidity of your oil, as compared with the Downer Company's oil made prior to the discovery of your oil?

Ans. I attribute it to the removal by distillation of the thin, more volatile oils, with which the Downer oil, as made prior to my discovery, was to a considerable degree associated, leaving only in my deodorized oil the actual oleaginous properties, whilst in the oil made by the Downer Company, prior to my discovery, the oleaginous properties of the oil were reduced or diluted by the admixture of those bodies above referred to, which are removed from my deodorized oil.

Cross-int. 47. Are these thin, more volatile oils, which you say are removed from your deodorized oil, the sources or causes of the odor, to the removal of which your invention relates?

Ans. I so regard them. The odors either are due wholly to this

class of oils, or are in some manner, I know not what, associated with them; as their removal produces my deodorized oil.

Cross-int. 48. You say that the No. 2 oil, on which you were working at the time of your discovery, was too heavy for burning oil and too light for lubricating oil. Did this oil have an offensive smell?

Ans. It did.

Cross-int. 49. I understand that this oil was the result of a process or treatment, parts of which involved what you have described as a cracking of the heavy oil; am I right?

Ans. It was an oil that was a fraction or a portion of a redistillation of a cracked heavy oil.

Cross-int. 50. Did it contain the compounds of offensive odor which had been produced in such cracking of the heavy oil?

Ans. It possessed an odor that was peculiar to all distilled oils, and not particularly to that oil known as cracked oil.

Cross-int. 51. Had anything been done, between the time of the cracking of the oil and the complete production of the No. 2 oil, to free that oil from the compounds of offensive odor, which you have said are produced in the cracking of the heavy oil?

Ans. It had been treated with acids and alkalies in the usual manner, practised at the Downer Company's works, of treating cracked oil, and after treatment distilled for the purpose of separating the thin oils,
102 produced by the cracking process, from that portion which had not been cracked up, as before testified to.

Cross-int 52. If you take crude petroleum, and distil off the naphtha and then distil off the burning oil, will the oil which remains, without anything further being done to it, have any offensive odor?

Ans. It will have a slight odor of the crude petroleum, and if the distillation is carefully performed, very slight objectionable odors.

Cross-int. 53. Will it be your patent lubricating oil, substantially?

Ans. It will not be my patent lubricating oil, but totally different in physical properties, color, and body; and is solid or of a pasty consistence at quite high temperatures, and cannot be used for the purposes for which my oil is used.

Cross-int. 54. If you chill this oil, and press it to get out the paraffine, will it then be substantially your patent lubricating oil?

Ans. Were this pressing of the oil to remove the paraffine possible, which it is not, the product would still not be my deodorized oil.

Cross-int. 55. Why is not the getting out of the paraffine by chilling and pressing the oil possible?

Answer. Because until the oil has actually been raised in vapor, and distilled over, the paraffine refuses to arrange itself in crystalline form sufficiently to allow of its separation from the oil by that means, and this oil, when chilled and pressed, passes through the bags in precisely the same form and shape in which it was placed in them; and there is but one petroleum known in which the paraffine crystallizes without first distilling the entire product, and that is Rangoon or Burmese petroleum.

Cross-int. 56. If the oil, being crude petroleum, from which the naphthas have been distilled off, and then the burning oils have been distilled of, be raised in vapor and distilled over, so that the paraffine will be crystallized, and its separation from the oil made possible, will the oil of this last distillate, after the paraffine has been so separated from it, be your patent lubricating oil, substantially?

Ans. Those are just the conditions used, and to which the oil is subjected, in every case where my patent oil is produced, viz, the removal

by distillation of those thin and offensive oils which give the characteristic odor to the paraffine oils, as made before my discovery.

103 Cross-int. 57. Does the oil mentioned in the last question after the removal of the naphthas and the burning oils, contain paraffine, lubricating oil, and the thin and offensive oils you have just mentioned?

Ans. It does contain paraffine and lubricating oils, and in the ordinary distillation of those oils, there is associated with it more or less of the thin and offensive oil; but the process of distillation may be so conducted as to produce an oil containing paraffine and lubricating oil, and free from those thin and offensive oils referred to, by keeping the oil in the still, while undergoing distillation, at a temperature below that at which those thin and offensive oils are formed, by decomposition of the heavy oils, as stated in my patent; but the oils, when distilled over, have a slight pungent smell, [which readily yields to chemical treatment, and the product is the deodorized lubricating oil.]

(The words in brackets objected to as irresponsive to the question.)

Cross-int. 58. Observe that I speak, in my last question, of crude petroleum, from which the naphthas and the burning oils have been removed; does the oil at that stage, and before it undergoes any further distillation, contain the thin and offensive oils you have just mentioned?

Ans. Not if the distillation has been carefully performed.

Cross-int. 59. You mean, I suppose, the distillation by which the naphthas and the burning oils were carried over?

Ans. I do.

Adjourned.

MONDAY, *Nov.* 7, 1870.

Cross int. 60. Referring to the fifty-sixth cross-interrogatory, if there be any thin and offensive oils in the oil which is raised in vapor, and distilled over, as supposed in that interrogatory, will such thin and offensive oils be vaporized with the heavier oil, carried over with it, and condensed with it?

Ans. If such oils be formed, they go over together, usually.

Cross-int. 61. Suppose that they be not formed in this last distillation, but only exist from the previous distillations, as put in my question. Please answer that question.

Ans. Do you mean the distillation from the crude petroleum of the naphthas and burning oils referred to?

104 Cross-int. 62. I will put my question again. In your answer to the fifty-second cross-question, you said "that, if you take crude petroleum and distil off the naphtha, and then distil off the burning oil, the oil which remains, nothing further being done to it, will have a slight odor of the crude petroleum, and if the distillation is carefully performed, very slight objectionable odors." Now, suppose that the said oil, so remaining, be raised in vapor, and carried over to the condenser, said distillation being so conducted that no more objectionable odors or compounds be formed thereby, will the odors first mentioned go over into the condenser with the oil, and be condensed with it?

Ans. I can only answer that one way, as answered to a previous question, that objectionable odors always are accompanied and associated with an oil distilled over, and such objectionable odors readily yield to chemical treatment, and are removed, when no thin and offensive oils are associated with the distillate.

Cross-int. 63. Please hear my question read again, and answer it.

Ans. You in this question refer, if I understand you, to the words, a

slight odor of the crude petroleum and slight objectionable odors. Am I right?

Cross-int. 64. Yes.

Ans. When that oil is distilled, the slight petroleum odor referred to may be entirely changed, and the distillate have a modified objectionable odor instead. I never saw a distillate that had a petroleum odor; as associated with the crude petroleum, I mean.

Cross-int. 65. Well, as a matter of fact, will "the slight odor of the crude petroleum and slight objectionable odors," or whatever it is that yields or makes them, be raised in vapor with the oil in which they are present, and go over and be condensed with that oil; or will they not or don't you know?

Ans. The entire product rises in vapor and goes over with all it contains, excepting the coke, which remains back in the distilling apparatus as a residuum, but the odor of the oil after distillation is totally different from what it was before distillation, and much more offensive.

Cross-int. 66. The oil in this condition, with nothing further done to it, you would consider, I suppose, a substantially different oil from yours; even after the paraffine was removed by chilling and pressing?

Ans. It would be different from my oil, as respects its odor, entirely.

Cross-int. 67. In what respect would it be like your oil?

105 Ans. If it contained no thin oils, thereby being greatly increased in body and oleaginous properties, it would, in that respect, resemble my oil, but I should not deem an oil, having the offensive odor that that oil would possess, my deodorized hydrocarbon oil; but, as I have before stated, such objectionable odors readily yield to chemical treatment and are removed, and such oil would be my deodorized hydrocarbon oil, when so chemically treated as to remove the odors; because it contained no thin offensive oils, and was free from the characteristic odors of heavy hydrocarbon oils, as made before my discovery.

Cross-int. 68. What is that chemical treatment to which such objectionable odors would readily yield?

Ans. A slight treatment of acid and alkali.

Cross-int. 69. In operating upon heavy hydrocarbon oils for the purpose of producing your heavy lubricating oil, if you carry on the distillation until the oil which comes from the condenser has a gravity of thirty-six degrees Baumé, will a cracking or breaking up of the heavy oil in the still have taken place?

Ans. It will not.

Cross-int. 70. At this point does the liquid in the still become dark in color?

Ans. It becomes slightly darkened in color.

Cross-int. 71. To what is this discoloration due?

Ans. To a slight scorching of the oil, as answered to a former question.

Cross-int. 72. Is this scorching of the oil a decomposition of it, by which a body, relatively rich in carbon, is produced, which remains in the still, discoloring more or less the liquid therein, and a body, relatively poor in carbon, which passes over in vapor to the condenser?

Ans. I think not, but is rather a mere scorching or discoloring of the oil by the action of the heat applied to it, much the same as the color is affected by heating fatty oils to like temperatures.

Cross-int. 73. Do you know how the sales of paraffine oils generally in 1868 and 1869 compared with previous years, and how the sales of these two years compared with one another, as to increase or decrease?

I speak not of the Downer Company's trade, but of the general trade, and I refer both to the domestic and the export trade.

106 Ans. There was a general complaint among the manufacturers of paraffine oils during those years, 1868 and 1869, of dulness and want of demand for the article known as paraffine oil, and to the best of my knowledge a decided falling off of the consumption in 1869, as compared to 1868, the railroads, who were large consumers of oils, generally using the article known as native oil, or preparations in imitation of that article made from the residuum of petroleum and other articles; and the exportation of paraffine oils has been in quite limited quantities. Quite a number of factories for the manufacture of paraffine oil, during the summer of 1869, and the last summer, have been closed.

Cross-int. 74. Who are the two customers located in the city of Providence, R. I., who continue to a certain extent to purchase the Downer Company's old oil mentioned in your fourteenth answer in chief?

Ans. Saunders & Benedict, and W. A. Robinson & Co.

Cross-int. 75. Please refer to your answer to the twenty-first cross-interrogatory, and say at what temperature, below six hundred Fahrenheit, the production of the compounds there referred to may take place, when steam is used in combination with the ordinary distillation?

Ans. I do not know at just what point, below six hundred, the changes referred to take place, but I think it not much below six hundred.

Cross-int. 76. That is a little vague. Can't you come any nearer to it?

Ans. I will state, that usually in distilling oil, when steam is used in combination with fire, the steam is used in minute quantities, and merely acts as an assistant or auxiliary in carrying over the products of distillation, and its use tends to somewhat lower the temperature in the still, but just what the reduction of temperature is, I am unable to state.

Cross-int. 77. How much paraffine do you get to a barrel of crude petroleum, when treated so as to produce your patent lubricating oil?

Ans. From seven to ten pounds of scale paraffine, according to the crude petroleum we use; that is, whether it be a petroleum of high or low gravity; but there is more paraffine, than that named, in the oil, which we do not attempt to save, but let it go into the burning oil portion of the distillate.

107 Cross-int. 78. Does it go over into the burning-oil as the result of what you have described as the cracking of the heavy oil?

Ans. It does not, but exists in that portion of the distillate, between forty and thirty-six degrees Baumé, in the regular distillation of the petroleum where we separate it into heavy oils and burning-oils. Since I began the manufacture of my deodorized oil we do not carry on the process known as cracking, as we do not produce in our manufacture of petroleum oils a sufficient quantity of the heavy portion to supply the demand for our deodorized oil, but are large purchasers in the market of heavy oils from other manufacturers.

Cross-int. 79. At the point where you say the liquid in the still is discolored by the slight scorching operation you have mentioned does the distillate show any discoloration?

Ans. It does not.

Cross-int. 80. Have you ever known of the use of superheated steam with a vacuum for the purpose of assisting the distillation of petroleum prior to its description in the patent of Dr. Tweddle, to which you have referred?

Ans. I never have except as it may be found in prior patents to which I have referred.

JOSHUA MERRILL.

Deposition of S. Dana Hayes, taken before H. Farnam Smith, esq., special examiner, Tuesday, Nov. 8, 1870.

Direct examination by Chauncey Smith, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. S. Dana Hayes; thirty-one years of age; reside in Brookline, Mass.; am a consulting and analytical chemist, and assayer to the commonwealth of Massachusetts.

Int. 2. Have you ever acted as an expert in the trial of patent cases in the courts of the United States—in chemical cases especially—or in proceedings before the Patent-Office?

108 Ans. I have had such experience, and been frequently called upon as expert in such cases.

Int. 3. What experience have you had as chemist in that branch of chemistry and the manufacturing arts which relates to the chemistry and manufacture of petroleum products or the coal-oils?

Ans. I have made special study of this branch of chemistry, both as practical in the arts and theoretically. I have had three years' experience as a practical manufacturer or distiller of petroleum; have been in frequent consultation with other manufacturers since the introduction of this industry. I have kept myself informed as well as possible of what has been done in this department of the arts.

Int. 4. To what extent, prior to 1868, did you have the opportunity and the occasion for examining the products of different manufacturers of petroleum and of becoming acquainted with the product and processes and apparatus employed by them in this branch of industry?

Ans. I have erected works and have visited the works of others, and have been more or less constantly employed in examining the products of other manufacturers since the introduction of this industry, in 1860 and 1861; have had frequent consultations with other manufacturers, have given advice, and have suggested and seen the different forms of apparatus employed.

Int. 5. Will you describe generally the commercial products which are obtained from petroleum, and the different means or agencies by which they are obtained?

Ans. The products may be divided into five different classes: First, naphthas; secondly, burning oils; thirdly, lubricating, heavy oils; fourthly, paraffine; fifthly, tarry matter or separated carbon. These products, as produced by distillation of petroleum by the ordinary means, are more or less offensive to smell. They have peculiar inherent odors, excepting the paraffine and separated carbon. They are produced by distillation in apparatus of different forms. Stills or retorts heated by fires are the commonest forms of such apparatus. Steam has frequently been used as an auxiliary agent. Vacuum pumps and apparatuses have been used, and apparatus differs greatly in form, position, and general construction.

Int. 6. Do you know, as a matter of common scientific knowledge, whether, prior to the time I have before named, any efforts had

109 been made by chemists to obtain the oil products of petroleum in their greatest purity; and with what success as respects the elim-

ination of the odor which you referred to pertaining to the oils produced in the ordinary methods of distillation?

Ans. The manufacture of these products in a state of purity was a desideratum among chemists. I have myself worked to attain such results, and know that others have done so, but the success was entirely unsatisfactory. Although a multitude of processes and apparatus have been tried, the products always retained peculiar odors, and were not thoroughly purified.

Int. 7. Take that product of petroleum which you have spoken of as lubricating, heavy oils. Will you describe their characteristics as they were known to you, coming from different manufacturers, and as found in the market, and the uses to which they were put?

Ans. These oils always had peculiar and offensive odors, peculiar colors, peculiar tastes. They were mixtures of light and heavy bodies. They were used for lubricating machinery of different kinds, and for mixing with other oils, but were never entirely satisfactory to the consumers.

Int. 8. In mixing with other oils, what was their behavior as respects the odor which they possess?

Ans. The odors possessed by these oils are persistent, and when mixed with other oils there is an apparent development of the peculiar odors. The odor of these oils in mass was not always so offensive as when they were mixed with and diluted by other oils.

Int. 9. Have you examined the patent granted to Joshua Merrill, May 18, 1869, and numbered 90284, and made yourself familiar with the method there described for manufacturing a lubricating oil? If so, will you state whether you have repeated the process therein described, and ascertained, by direct experiment, whether the oil produced possesses the characters attributed to it in the patent?

Ans. I have made myself familiar with the patent. I have manufactured oil by the process described, following the direction therein contained, and the oil so obtained has the character described.

Int. 10. Have you had an opportunity of witnessing the production of this oil at the manufactory of the Downer Kerosene Company, at South Boston? If so, how does the oil produced there on a large scale correspond with that described in the patent and that which you produced in repeating the method described in the patent?

Ans. I have witnessed the production of this oil at the Downer works. The oils mentioned correspond very closely; the differences are slight, and due to want of care and skill in the manufacture, in other words, to errors of experiment.

Int. 11. Will you state how these oils which you made in repeating the process described in the patent referred to, and which are produced by the Downer Kerosene Company, correspond with, or differ from, the lubricating oils with which you were acquainted prior to 1868, or with such as you have known, produced by other manufacturers since that time?

Ans. They are far superior for the purposes for which they are intended. They differ essentially in the absence of odor, comparative absence of color, absence of taste, absence of light oils, and in their lubricating qualities. They belong to a different commercial class of oils.

Int. 12. State, if you know, what their behavior is when mixed with other oils, and how, in this respect, they compare with those with which

you were acquainted prior to 1868, and with the oils of other manufacturers produced since that time.

Ans. I have made many mixtures of these oils with animal and other oils, and have found them to impart little or no odor to the animal oils when mixed in certain proportions—in this respect differing materially and greatly from all other hydrocarbon oils in the market prior to 1868 They differ in this respect from all oils but one now in the market.

Int. 13. What is that exception which you make?

Answer. Tweddle's neutral topaz oil.

Int. 14. Will you state whether specimens of this last-named oil were furnished you by Mr. Joshua Merrill as an oil sold by the defendants in this case; and, if so, state when he furnished them to you; and if you have taken any from a barrel in Mr. Merrill's possession, will you state what marks or characters you found upon such barrel, and where it was at the time you took the sample?

Ans. Mr. Merrill furnished me with such sample in July last, I think. I did take a sample from a barrel marked on one end "Eclipse neutral topaz oil, manufactured by Herbert W. C. Tweddle, made under his patents, Pittsburg, Pa;" and on the other end marked "J. R. Bart-
111 lett, Boston; forty-five galls." The barrel was in the delivery department at the Downer Kerosene Oil-Works, and I took a sample from it on the 15th of September last.

Int. 15. Will you state whether you made an examination of the specimens thus obtained? If so, will you state how far they possessed the qualities which you find described in the patent above referred to; and comparing them with the oils which you produce in repeating the process described in Merrill's patent, will you state how you found them to correspond or differ, especially in such particulars as to which Merrill's oil differs from such as you had previously been acquainted with; and in making this comparison, will you state how much importance you attach to various points of resemblance or difference, and whether or not you find them to be substantially alike as to those methods which distinguish Merrill's oils from other oils?

Ans. I have made very careful examination of these samples, and have compared them with the oil made at the Downer Kerosene Oil-Works, and with that made by myself when following the directions given in Merrill's patent, and have also compared them with other hydrocarbon oils in the market. These samples possessed all the qualities described in Merrill's patent. They are very nearly identical with the oil made at the Downer Kerosene Oil-Works and with that which I made. They are substantially the same, but differ greatly from any other hydrocarbon oils known in the arts. These specimens and those manufactured as stated above correspond and agree very closely in the following physical characters, which are the only characters of importance in commerce and in the arts: First, absence of offensive odors; second, absence of opalescence, fluorescence, or the presence of blue or green tints; third, absence of taste; fourth, absence of light hydrocarbons; fifth, in mixing qualities; sixth, in lubricating qualities; seventh, in density; eighth, in boiling-points; ninth, in absence of chemicals. I attach most and greatest importance to their similarity in absence of odor, opalescence, and taste. In these respects they differ greatly from any other oils in the market, and form a new commercial class of oils.

These characteristics enable them to be used where hydrocarbon oils, as previously made, could not have been used in the arts. These

specimens and those manufactured as above stated are substantially the same, and very different from other petroleum oils.

112 Int. 16. When you say that you attach most importance to the absence of odor, opalescence, and taste, do you mean that you attach most importance to them as indicateing that the two oils are substantially alike, or that these qualities of themselves are of greater importance than the others in their commercial character?

Ans. I attach greatest importance to these characteristics, as establishing the difference between these and other oils, also as showing their similarity. At the same time they are highly-valued characteristics in commerce, but would be of little importance, if the oils did not possess other qualities which I have mentioned.

Int. 17. As to the absence of opalescence in these samples, as compared with the oil which you obtained, when repeating the process described in Merrill's patent, which do you find to be the most free from the green and blue tints?

Ans. Neither of these oils is absolutely free from opalescence, but that taken from the barrel is freer from it than what I manufactured. Both differ greatly in this respect from other petroleum oils in commerce.

Int. 18. As to the absence of odor and taste, how did the samples of the defendant's oil differ from that made by you, or from that manufactured at the Downer works?

Ans. In regard to odor and taste, I have been unable to detect any appreciable difference between them by the most delicate tests that have occurred to me; and I have tried a great many tests upon them. If there is any difference, the oil which I made is a little better than the others in these characters.

Int. 19. You speak of their mixing qualities. Will you explain a little more what you mean in that respect, and how they compared with each other? Which was the better in that respect?

Ans. By mixing qualities, I mean that when these oils are mixed with others, fatty or animal oils, for instance, their peculiar characteristics of color, odor, and taste are lost and disguised by the animal oils. With regard to mixing qualities, there is very little, if any, difference. There is no material difference. They are substantially the same.

Int. 20. You speak of the absence of the light hydrocarbons as one feature in which the oils compared resemble each other. Was there any difference in this respect in the oils? If so, which one was the purest from these? What means did you take for ascertaining this fact?

113 Ans. There were very slight differences; the sample that I made myself being rather freer from light oils than the others, and that made at the Downer Kerosene Oil-Works containing a very little less than defendants'. The absence of light hydrocarbons was determined by heating these oils, at different temperatures, in glass retorts, and determining the proportion of light hydrocarbons that would separate from them, and great care is necessary and was exercised in these determinations. Differently shaped retorts would yield different results, but these comparisons of the oils were always made in the same apparatus.

Int. 21. How did these oils correspond in density and boiling-points?

Ans. They correspondence is not so close in these respects. Both of these oils are lighter in density than others in the market, and they both boil at higher temperatures than others in the market. The oil made at the Downer Kerosene Oil-Works has a density of twenty-nine and 8-10 degrees Baumé. The oil that I made has a density from thirty

and 8-10 to thirty-one and 4-10 degrees Baumé. The sample from the barrel has a density of thirty-four and 8-10 degrees Baumé. The boiling-point of Merrill's oil, as made at the works, is six hundred degrees Fahrenheit. The boiling-point of the oil taken from the barrel is five hundred eighty-five degrees. I have not determined exactly the boiling-point of the oil made by me, but know it to be above five hundred and eighty degrees.

Adjourned.

WEDNESDAY, *Nov.* 9, 1870.

Int. 22. You spoke of the absence of chemicals in the samples of the defendants' oil, which you examined, as one feature in respect to which they resembled the oils made in the manner described in Merrill's patents. Are you able, from the examination which you gave them, to form a judgment as to whether that freedom from the offensive odors which belonged to heavy hydrocarbon oils, formerly known to you, which you have mentioned as a characteristic of the defendants' oil, was produced by the action of chemicals or by the method of distillation? If so, state what your judgment is.

Ans. I am able to form such judgment. The absence of these peculiar odors is not due to the action of chemicals, but it is due to
114 the mode of distillation. The other oils known in commerce have been so thoroughly treated with chemicals, that parts of the chemical agents are left remaining in them, but still they possess peculiar and persistent odors.

Int. 23. The use of a vacuum in distillation, in connection with fire and steam, has been spoken of by yourself and other witnesses as one method by which the distillation of petroleum oils has been practised by manufacturers. If you made any experiments in producing Merrill's oil by the method described in his patent, but with the addition to the apparatus of a means for maintaining a vacuum, will you state what results you obtained, and how they compared with the results described in the patent?

Ans. I did make such an experiment, distilling in an apparatus like that described in Merrill's patent, keeping up at the same time a partail vacuum; and with this apparatus I obtained an oil having the characters of Merrill's deodorized hydrocarbon oil, and differing greatly from other oils in the market.

Int. 24. What was the degree of vacuum that you obtained?

Ans. It varied from twenty and one-half to twenty-six inches of the gauge. It was a partial vacuum.

Int. 25. In Merrill's patent, before referred to, he speaks of heavy hydrocarbon oil as the material from which he makes his deodorized oil; but near the end of his patent I find this passage: "It will also be evident to those skilled in the art that my invention will be used, if the above-mentioned process be worked, to produce the deodorized heavy oils above described, from distilled hydrocarbon oils, from which the lighter-burning oils and naphthas have not been separated, so long as they contain heavy oils, because the naphthas and lighter oils will go over first, leaving the heavy oil in the still to be operated upon; and also because, as before stated, the distilled heavy oils always contain more or less of the lighter bodies, owing to the breaking up of a portion of the heavy crude oil in the process of distillation." Will you state what this material is described in this passage; how it differs from the heavy hydrocarbon oils spoken of before in the patent; and how it differs from crude petroleum?

Ans. The material so described must be a distillate from petroleum

from which the tarry matter and separated carbon have been re-
115 moved. It may or may not contain paraffine. It certainly contains light, odorous oil, but is free from tarry matter or separated carbon. It differs in this respect from crude petroleum, which contains tarry matter, and from common distilled heavy hydrocarbon oils, which do not contain so large a proportion of light oils.

Int. 26. Did you distil any crude petroleum in the manner described in Merrill's patent, for the purpose of ascertaining whether you could obtain the oil described in his patent from that material? If so, will you state what results you obtained?

Ans. I did distil crude petroleum, but not in the exact manner described in Merrill's patent.

Int. 27. State in what manner you did do it, and in what respect it varied from the method described in Merrill's patent. I refer in this question to the use of fire and steam, in the manner described in that patent.

Ans. I did distil crude petroleum by the aid of fire and steam applied in the manner described in Merrill's patent. I continued the distillation, lifting over the vapors of heavy hydrocarbons, in the last part of the process, without decomposing them, or decomposing them as slightly as possible; and in this way I obtained an oil having the characters of Merrill's deodorized oil.

Int. 28. In this experiment were the tarry matters and paraffine separated from the heavy oil which you obtained; and, if so, at what stage?

Ans. The tarry matters were separated at the end of the distillation. The paraffine was removed from the distilled oil after the tarry matters had been removed.

Int. 29. When you say that the tarry matters were removed at the end of the distillation, do you mean that they remained in the still, in the same manner as under the ordinary distillation of petroleum?

Ans. They did. I include with tarry matters separated carbon.

Int. 30. Will you state whether you found in this experiment that the presence of the paraffine tarry matters and separated carbon in the still interfered with the separation of the heavy hydrocarbon oils from the light and offensive bodies; and whether or not you obtained, from the distillates going over before you reached the dividing point for the heavy oil, the same body as when you used the heavy hydrocar-
116 bon oil, spoken of in Merrill's patent, as the material from which you obtained the deodorized oil?

Ans. The presence of these substances did not interfere with the separation of light odorous hydrocarbons. I did obtain in this distillation bodies like those obtained when making the deodorized oil from heavy hydrocarbons.

Int. 31. If you varied this experiment with crude petroleum and the use of fire and steam, by the addition of an apparatus for maintaining a vacuum, during the distillation, will you state what results you obtained?

Ans. I did distil crude petroleum, from which the naphthas had previously been removed, by steam distillation, by the aid of fire, vacuum, and steam. By carefully conducting the distillation, I obtained a deodorized heavy hydrocarbon oil, having the characters of Merrill's heavy deodorized hydrocarbon, and which, after a slight chemical treatment, was nearly identical with the oil made regularly at the Downer Kerosene Oil Works. It was entirely different from other oils of this class in the market.

Int. 32. At what stage did you separate the tarry matter and separated carbon and the paraffine, if you did this?

Ans. I separated the tarry matter and carbon at the end of the distillation. They were left behind in the still. I separated the paraffine partially from the distilled heavy oil afterwards.

Int. 33. How did the products which were distilled over in this experiment, as you approached the dividing line between the light hydrocarbon and the heavy hydrocarbon oil, compare with those which you obtained in distilling the heavy hydrocarbon oil, mentioned in Merrill's patent, by the method described there?

Ans. They were identical in odor and density, the characteristics of most importance.

Int. 34. In the various experiments in distilling oil which you have mentioned in the course of your deposition, were you operating upon small quantities in the laboratory, or in larger quantities, approaching more nearly the usual conditions of manufacture? If so, state upon what quantities you operated.

Ans. I operated on comparatively large quantities, on a manufacturing scale. I used a retort that had a capacity of more than one
117 hundred and fifty gallons, and I put into it about that quantity of material for each experiment.

Int. 35. If you have any samples of the oil that you produced, when using the heavy hydrocarbon oils mentioned in Merrill's patent as the material from which he produced his oil, and when you followed the directions of that patent, and also when you distilled crude petroleum by the aid of a fire, steam, and a vacuum, as you have stated, will you produce them as exhibits in the case; and if you have also specimens of the products you obtained in those experiments, as the distillation approached the dividing point between light and heavy oils, will you produce those also?

Ans. I now produce Exhibit No. 14, which is a deodorized hydrocarbon oil, made by me from heavy hydrocarbons, Aug. 19, 1870. Exhibit No. 15, which is a deodorized oil, made by me, Sept. 1, 1870. It is an oil also made from heavy hydrocarbon oils. These exhibits represent two experiments. Exhibit No. 16 is a deodorized heavy oil, made by me, from petroleum, Aug. 18, 1870. Exhibit No. 17 is a deodorized oil, made by me, from petroleum, Aug. 31, 1870. These two exhibits represent two different experiments. Exhibits Nos. 14 and 15 were made when following the directions given in Merrill's patent. Exhibits Nos. 16 and 17 were made from crude oil, by the aid of fire, vacuum, and steam distillations. Exhibit No. 18 is an odorous oil, obtained when distilling crude petroleum, by the aid of fire, vacuum, and steam, Aug. 31, 1870, when near the point of separation between light and heavy oils. Exhibit No. 19 is one of the light odorous oils obtained when distilling heavy hydrocarbons, as directed in Merrill's patent, obtained by me, Sept. 1, 1870. Exhibit No. 20 is a light, odorous oil, obtained when distilling crude petroleum, by the aid of fire, vacuum, and steam, Aug. 31, 1870. Exhibits Nos. 19 and 20 are very nearly identical.

Int. 36. Have you, from your examination of the samples of the defendants' oil, formed any judgment as to whether it was produced by the same method, or substantially the same method, which is described in Merrill's patent, for the production of his deodorized oil?

Ans. I have formed such judgment from my knowledge and experience in this manufacture. I judge that the defendants' oil was made by a process of distillation substantially the same as that described in Merrill's patent.

118 Cross-examination by Causten Browne, esq.:

Cross-int. 1. What do you understand to be substantially the process of distillation described in Merrill's patent, for the purpose of producing his deodorized oil?

Ans. I understand, by this expression, a process that will produce such an oil as Merrill describes, by the use of similar apparatus.

Cross-int. 2. What do you understand to be substantially the process described by Merrill in the patent, as performed by the apparatus there described?

Ans. I understand the process to be one that eliminates the deodorized heavy hydrocarbon oils in a state of great purity; a process that separates from them the tarry matters and separated carbon, as well as the light and odorous bodies that are present, or may be produced.

Cross-int. 3. What do you understand to be substantially the process, described in Merrill's patent, for the purpose of accomplishing these things?

Ans. In Merrill's patent he states the order in which he makes the separations mentioned in my last answer, and he also describes one form of apparatus in which these separations may be performed, and the means employed.

Cross-int. 4. What do you understand to be substantially the process described in Merrill's patent by which he makes these separations? I do not speak of the order in which they are made, or of the apparatus used.

Ans. Merrill describes a process of true fractional distillation, that separates bodies, formed or present, in the material he operates upon.

Cross-int. 5. Do you mean that the substantial process, described by him for making these separations, is a process of true fractional distillation.

Ans. The important part of the distillation described by Merrill is a true fractional distillation.

Cross-int. 6. No process for accomplishing these separations, which is not a true fractional distillation, is Merrill's process, substantially, in your judgment? Am I right?

Ans. No process which does not include true fractional distillation at one period of the operation would be substantially the same.

119 Cross-int. 7. What do you mean by that true fractional distillation which you say is the important part of the distillation described by Merrill?

Ans. I mean the separation by distillation of bodies that have been formed or are present, without decomposing these bodies.

Cross-int. 8. What are these bodies which Merrill's process, as you understand it, separates, without decomposing them?

Ans. The heavy, deodorized hydrocarbon oils.

Cross-int. 9. Specify them, if you please. I refer to those bodies which you have spoken of as formed or being present in the material he operates upon.

Ans. They are heavy hydrocarbon oils, such as I have described fully in my direct examination as being eliminated by distillation, when following the directions given in Merrill's patent. I have introduced a number of samples of these oils for your inspection. They are known in commerce as neutral oils.

Cross-int. 10. I want you to state, by reference to Merrill's specification, what the bodies are which he designs to separate by the use of his process, as he describes it, substantially.

Ans. Merrill describes, as the most important body that he separates

an oil that has been so completely divested of its fetid and pungent odors, having only a slight smell like a fatty oil, and that is oily and improved as a lubricator or for mixing purposes. This substance he separates from the tarry matters, and separated carbon, and light odorous oils of petroleum.

Cross int. 11. This substance which he so separates is his deodorized lubricating oil, is it?

Ans. He so describes it. We have been speaking of the description in his patent.

Cross-int. 12. Then, if I understand you, his process is a process by which he separates, from the material he operates upon, the tarry matters and separated carbon and light odorous oils of petroleum, and so produces his deodorized lubricating oil?

Ans. I understand his description to include the separation of these three bodies from the oil of great value which he eliminates.

Cross-int. 13. Will you answer my question more directly, if you can?

120 Ans. I have carefully answered, giving you my understanding of his description of his process.

Cross-int. 14. Is or is not, in your judgment, the process described in his patent substantially a process of separating from the material he operates upon the tarry matters and separated carbon and light odorous oils of petroleum for the purpose of producing his deodorized lubricating oil?

Ans. No.

Cross int. 15. You said, in answer to the fourth cross-interrogatory, that Merrill describes a process of true fractional distillation that separates bodies, formed or present, in the material he operates upon. What do you refer to as bodies formed, and what do you refer to as bodies present, in distinction from one another, and as both distinguished from the resulting deodorized oil?

Ans. The material which Merrill operates upon is one that has been distilled. In this previous distillation odorous bodies have been formed or certainly are present, and he removes these from his deodorized heavy oil, the tarry matters and separated carbon having been removed by the previous distillation mentioned and referred to in speaking of the previous distillation. I consider that Merrill's description involves the previous separation of tarry matters and separated carbon.

Cross-int. 16. You say the material Merrill operates upon is one that has been distilled; distilled for what purpose, and what has been taken from it?

Ans. That depends upon the original material. When the original material was petroleum, tarry matters or separated carbon were removed from it. I can't say for what purpose such materials were distilled, but know this distillation would remove the tarry matters and separated carbon from crude petroleum.

Cross-int. 17. Referring to the last question, have not the naphthas and burning oils also been removed from the material which Merrill operates upon?

Ans. Not necessarily.

Cross-int. 18. When you say that tarry matters or separated carbon were removed from the material Merrill operates upon, when that material was petroleum, do you mean that such removal was a result of a distillation of the petroleum?

121 Ans. When petroleum is distilled, tarry matters or separated

carbon are always removed from it. I don't know that I said that Merrill operated upon petroleum.

Cross-int. 19. Can you remove tarry matters and separated carbon from petroleum except by distillation? If so, how?

Ans. Certain tarry matters can be separated from petroleum by chemical agents. Not entirely, and it is not a practical process. Separated carbon can only be removed by distillation.

Cross-int. 20. When tarry matters and separated carbon have been removed by distillation from petroleum, will not the naphthas and burning oils have been also removed from the petroleum?

Ans. Not necessarily.

Cross-int. 21. Do you mean to be understood that the substance of Merrill's process, as applied to petroleum, is the separation from the heavy oil of odorous bodies, which have been formed, or are present in the petroleum, after tarry matters and separated carbon have been removed?

Ans. I mean that the substance of the process described in Merrill's patent, when applied to petroleum, includes the separation of light, odorous bodies, and of tarry matters, and separated carbon, and of his new deodorized o l. Because, if Merrill's oil contained these substances, it would not be the article which it is.

Cross-int. 22. You say in answer to the fifteenth cross-interrogatory, "the material which Merrill operates upon is one that has been distilled." And in answer to the sixteenth cross-interrogatory, where you are asked, "Distilled for what purpose, and what has been taken from it?" you say, "When the original material was petroleum, tarry matters or separated carbon were removed from it." If I understand you, then, the material which Merrill operates upon, when that material is petroleum, is one from which tarry matters and separated carbon have been removed by distillation. Do you so mean?

Ans. I do.

Cross-int. 23. Do you understand the substance of Merrill's process, described in his specification to be the separation of odorous bodies from petroleum, (when his process is applied to petroleum,) which has undergone a distillation, by which tarry matters and separated carbon have been removed?

122 Ans. That is exactly the meaning of one clause in Merrill's patent.

Cross int. 24. That does not quite answer my question.

Ans. Then I must refer you to Merrill's patent.

Cross-int. 25. In your direct examination you said, that from your knowledge and experience of this manufacture, you judged that the defendants' oil was made by a proce s of distillation, substantially the same as that described in Merrill's patent. I am now endeavoring to ascertain what, as a chemical expert, you mean by the substantial process of distillation, or, in other words, the substance of the process of distillation described in Merrill's patent, as distinguished from those things which are not of the substance of it. Do you understand the meaning of the words I have just used, or do you not?

Ans. I do. I have, and will endeavor to answer all your questions, to the best of my ability.

Cross-int. 26. Then please answer this question, which has been put to you before. Do you understand the substance of Merrill's process described in his specification to be the separation of odorous bodies from petroleum, (when his process is applied to petroleum,) which has

undergone a distillation by which tarry matters and separated carbon have been removed?

Ans. I am sorry to be so misunderstood. There is a clause in Merrill's patent that states a case such as you have supposed. I will read it, if you desire.

Cross-int. 27. I desire nothing but to have my question answered; please answer it.

Ans. Merrill's patent describes, as one of the materials that he operates upon, just such a material as you have described above; and he does separate from this the odorous bodies. He also eliminates from it his deodorized heavy hydrocarbon oil. This is certainly part of the substance of Merrill's described process.

Cross-int. 28. You say that from your knowledge and experience of this manufacture, you judge that the defendants' oil was made by a process of distillation substantially the same as that described in Merrill's patent; will you state the reasons of this judgment?

Ans. I formed that judgment because the defendants' oil is free from tarry matters and separated carbon, and from light odorous oils. It is evidently a product of the distillation of petroleum, and is the
123 eliminated heavy oil portion of such distillation, and differs from any other oil in the market, excepting that produced as described in Merrill's patent; and it is entirely different from oils produced when distilling petroleums by the ordinary methods.

Cross-int. 29. In your answer to the fifth direct interrogatory you say that the commercial products which are obtained from petroleum have peculiar inherent odors, excepting the paraffine and separated carbons. Do those odors exist in crude petroleum?

Ans. Those odors are produced by the destructive distillation of crude petroleum. If the products of the ordinary distillation of petroleum be mingled together the mixture will not have the same characters and odor as crude petroleum. They are produced from petroleum, and do not exist ready formed in it.

Cross-int. 30. What is this destructive distillation of which you speak that develops those offensive odors? What are the conditions under which destructive distillation takes place?

Ans. This consists in the destruction of the material operated upon and the production of different bodies from it. Crude petroleum is a very unstable material. It is destroyed when heated in a still even at comparatively low temperatures. The ordinary distillation of petroleums is always destructive, and not a mere separation of bodies that exist in it.

Cross-int. 31. What are the signs that destructive distillation has taken place in the case of a distillation of crude petroleum?

Ans. The proof is that if the products be mingled together they do not yield the original material.

Cross-int. 32. Suppose that the offensive or the peculiar inherent odors above mentioned, which are developed in the distillation of naphthas from crude petroleum, go over with the distillate, and the distillation be continued for the production of illuminating oil, and the odors developed in this last distillation go over with the distillate, and the distillation is then continued for the purpose of producing lubricating oil, and the odors developed by this last distillation go over with the distillate into a condenser, separate from the previous distillates, and are there condensed with such last distillation, and are never afterwards removed from it; will such a mode of producing lubricating oil embody, in your judgment, Merrill's process substantially?

124 Ans. Not if the distillation is conducted by means of fire alone; because such distillation would not produce a heavy oil like Merrill's.

Cross-int. 33. No matter how the distillation is conducted. So long as the offensive or peculiar inherent odors above mentioned, which are developed in the distillation, go over with the distillate, and are condensed with it, and not afterwards removed from it, will such a mode of making lubricating oil embody, in your judgment, Merrill's process, substantially?

Ans. If the distillation be conducted with the aid of certain auxiliaries, the offensive and peculiar odors referred to are not produced during the distillation of the heavy oil. If the distillation was such as not to produce the aforesaid peculiar odors, it would involve the principle described in Merrill's patent. Otherwise the distillation would not embody his processes.

Cross-int. 34. What are the auxiliaries you refer to?

Ans. Some agents which acting mechanically lift over or waft over the vapors of heavy oil, as soon after they are formed as possible, before they are decomposed, and also the exercise of unusual care during this stage of the distillation.

Cross int. 35. If I understand you, then, a process by which the peculiar inherent odors, which are developed in the distillation of petroleum, are removed by distillation or otherwise, and a process in which the distillation of petroleum is so conducted that such peculiar inherent odors are not developed at all, are both within the principle of Merrill's process, as you understand it. Is that so?

Ans. I do not understand your question, because it is impossible to distil the crude petroleum without producing some of these peculiar odors in the earlier stages of the distillation. I think the process which you have supposed in the last part of your question is an impossible one.

Cross int. 36. I refer you to your answer to the thirty-third cross-interrogatory, in which you say, "If the distillation be conducted with the aid of certain auxiliaries, the offensive and peculiar odors referred to are not produced during the distillation of the heavy oil. If the distillation was such as not to produce the aforesaid peculiar odors, it would involve the principle described in Merrill's patent?" If I have misunderstood your meaning in that answer, please explain wherein.

125 Ans. I think you misunderstood. I then referred particularly to the distillation of the heavy oils, which is a part of the entire distillation. Crude petroleum must necessarily undergo destructive distillation. The heavy oils may be distilled without destructive distillation, by the aid of care and the necessary auxiliaries. In the entire distillation of petroleum there is a point at which destructive distillation may be checked, and fractional distillation continued to the end of the operation, or where destructive distillation may be checked, and the remaining oils separated from the tarry matter and carbon, by being lifted out of the still in the form of vapor.

Cross-int. 37. Will the distillation of naphtha from crude petroleum be attended by destructive distillation, developing the said peculiar inherent odors, which will characterize the oil left in the still?

Ans. It proves so, in practice.

Cross-int. 38. Will the distillation of illuminating oil from the oil so left be attended also by destructive distillations, developing like odors, which will characterize the oil left in the still after such distillation?

Ans. It will, during the early stages of the distillation of the illu-

minating oil in any apparatus used by manufacturers. Destructive distillation may be avoided, during the latter part of the distillation of illuminating oils, by the use of the necessary auxiliaries.

Cross int. 39. If the oil left in the still, after undergoing the two distillations just mentioned, and characterized by the peculiar inherent odors which have been developed in those distillations, be further distilled over into the condenser, and there condensed into oil, will the peculiar inherent odors characterize that oil?

Ans. If these distillations have been conducted in the ordinary way, yes. If, however, the auxiliaries referred to have been employed, the oil remaining in the still need not have the peculiar characteristic odors that I have referred to.

Adjourned.

Cross int. 40. You will observe that I have assumed the petroleum to have been subjected to three distillations; the first one, to remove the naphtha; and the second one, to remove the illuminating oils, by which two distillations there have been developed, by destructive distillation,
certain odors which characterize the oil remaining in the still after
126 these two distillations. We have now an oil which is characterized by the peculiar inherent odors you have referred to, and it is to be subjected to a third distillation, for the purpose of obtaining the lubricating oil. When such distillation has taken place, and the vapors of it have been condensed in the condenser into oil, will the peculiar inherent odors, which were in the oil in the still when this third distillation commenced, be present in the oil in the condenser when the distillation is finished?

Ans. Undoubtedly.

Cross-int. 41. And this will be so, I suppose, whether such last distillation has been performed by fire heat alone, or with the auxiliaries you have mentioned?

Ans. Yes; provided that these peculiar odors existed in the heavy oil at the commencement of your third distillation; and more odors may be developed, if the third distillation is continued destructively, whether by fire alone, or otherwise.

Cross-int. 42. If now, from the lubricating oil resulting as a distillate from this last distillation, the paraffine be separated, and the oil be subjected to no further treatment, will it, or not, in your judgment, be a lubricating oil substantially like Merrill's?

Ans. Certainly not.

Cross-int. 43. Why not?

Ans. Because it contains the peculiar inherent odors, which are not present in Merrill's oil, whether Merrill's oil has been treated by chemical agents, or not.

Cross-int. 44. If the three distillations to which I have referred in my recent questions be so conducted that the peculiar inherent odors mentioned by you are not developed by either of them, in any material degree, will the oil remaining as a distillate after the third distillation be substantially like Merrill's, in your judgment?

Ans. You now suppose an impossibility. It is impossible to so conduct the earlier distillations that these peculiar odors will not be produced. I have never been able to do it, and I do not think it has ever been accomplished in the arts.

Cross-int. 45. Why is it impossible?

Ans. I have previously stated that crude petroleum is a very unstable compound; that it is decomposed on the application of heat

127 at even comparatively low temperatures. The distillation of naphthas alone from petroleum destroys it, and produces new and peculiar odors, under all conditions practised in the art. This is not theory, but the actual results of experience.

Cross-int. 46. Is there no method known to you, whether a method of distillation by heat or otherwise, by which the naphthas can be removed from crude petroleum without the production of the peculiar odors you refer to?

Ans. I don't understand your question. Distillation involves the employment of heat; distillation cannot be conducted without heat.

Cross-int. 47. Can the naphthas be removed or separated from the crude petroleum by blowing common steam through it?

Ans. Partially. This is the common practice at many of the petroleum-refineries in this count'y.

Cross-int. 48. Is this a method of distillation?

Ans. It is.

Cross-int. 49. Is it attended by the production of the peculiar odors?

Ans. It is. And this is susceptible of proof in many ways. The lighter naphthas obtained from petroleum have very low boiling-points, and when heated by the steam, as you have stated, above their boiling-points, they decompose, either when in the form of vapor or when a liquid. These naphthas volatilize in the vapors of each other and undergo decomposition at comparatively low temperatures. Solid paraffines may be produced by the distillation of light naphthas. I mention this as an illustration of the destructive distillation of naphthas.

Cross-int. 50. What do you include in the term naphthas?

Ans. I use this term as manufacturers use it. It includes the bodies obtained from petroleum that have densities above sixty degrees Baumé.

Cross-int. 51. Is the production, which you suppose to take place, of the peculiar inherent odors in question in the distillation of the naphtha from crude pretoleum caused by the destruction of paraffine? If not, to what is it due?

Ans. I am stating results of my experience. I do not suppose, as you now assume, what I have stated. In the common petroleum of this country, such as comes from Pennsylvania, for instance, there is no paraffine. Paraffine is a product of the destructive distillation of
128 petroleum. The peculiar odors I have mentioned are produced by the destruction of petroleum.

Cross-int. 52. In your answer to the ninth direct interrogatory you say you have manufactured oil by the process described in the Merrill patent, following the directions therein contained, and the oil so obtained has the characters described. Did you use steam?

Ans. I did.

Cross-int. 53. Did you manufacture any oil by the use of fire heat alone, as directed in one part of that patent?

Ans. I did.

Cross-int. 54. Did you preserve a sample of it?

Ans. I did, and will produce my sample, if desired.

(In answer to this question witness produced sample, marked "Exhibit No. 21.")

Cross-int. 55. In your answer to the twelfth direct interrogatory you speak of the behavior of Merrill's oil when mixed with animal and other oils, and say that in this respect it differs materially and greatly from all other hydrocarbon oils in the market prior to 1868. What other hydrocarbon oils did you try for the purpose of making this comparison?

Ans. I tried samples of all the hydrocarbon oils that I could conven-

iently obtain which possessed any of the characters of Merrill's oil. I will mention Reed's, Richardson's, Merriam and Morgan's, Libby and Clark's, Lincoln's, Portland, oils manufactured at Salem, by Seccomb, Kehew and Thayer, oils that I made myself, Scotch oils, and others.

Cross-int. 56. When did you get the oil made at Salem by Seccomb, Kehew and Thayer?

Ans. I had had several samples directly from this firm. This firm exhibited their oils at exhibitions of the Mechanics' Charitable Association in this city, and I, as judge, had every opportunity for examining their manufactures. This firm manufacture, and did manufacture, oils for the Lightfoot Currying-Oil Company, and I have examined authenticated samples of their oil made for that company at different times. I have had consultations with their manufacturer or superintendent, John Howarth, on the subject of their oil; also with their agent, C. Toppan.

129 Cross-int. 57. Referring to your answer to the thirty-first interrogatory-in-chief, state whether the deodorized, heavy hydrocarbon oil which you say you obtained was a distillate, or whether it was the oil remaining in the still after removing, by distillation, the lighter oils.

Ans. It was both. At one stage of the operation it was oil remaining in the still, from which the lighter oils had been removed. When finished, it was a distillate.

Cross-int. 58. What did you do to it to finish it, as you use the word finish in your last answer?

Ans. I used the word finish there, meaning when the operation of distillation was ended.

Cross-int. 59. What did you do, if anything, to the oil remaining in the still after the lighter oils had been removed?

Ans. I distilled it over carefully by the aid of fire, vacuum, and steam. If you desire, I will give you full details of that experiment, which I performed twice.

Cross-int. 60. Please do so.

Ans. I put about one hundred and fifty gallons of crude oil which had been deprived of its gasoline, benzine, etc., by steam distillation, into a vacuum still, of such construction as to permit the vapors of distillation to be drawn over, so that they did not condense before leaving the still. By a perforated pipe, I admitted steam into the body of the still, keeping up, at the same time, a partial vacuum, and in connection with the steam-heat, I applied a fire-heat to the outside of the still. The distillation was carried on, the vapors being drawn off, and condensed into illuminating oil, until the distillate showed a density of about thirty-seven degrees Baumé, and then the contents of the still contained a large percentage of paraffine. The distillate was then drawn off into another receiver. I continued the distillation with a comparatively low heat, so that the heavier ingredients of the oil should not be decomposed, but, being vaporized, were drawn over into the condenser. I conducted the distillation as long as any yield of valuble vapor could be obtained, keeping the condenser warm to prevent solidification of the paraffine. I then chilled and pressed the distillate, removing the paraffine, and removed the pungent odor of the expressed oil by chemical treament. I repeated this experiment with some variations.

130 Cross-int. 61. In producing the various oils mentioned in your answer to the thirty-fifth direct interrogatory, did you use chemicals in any part of the process for any of the oils; if so, what?

Ans. The oils made by me, which are represented by Exhibits Nos. 14, 15, 16, and 17, were all submitted to light chemical treatment, in order to remove from them a pungent odor known among manufacturers as a "still smell," sometimes as a "burnt smell," which is entirely different from the persistent and peculiar odors which I have always described as such in my evidence. The oils represented by Exhibits Nos. 18, 19, and 20 were not submitted to chemical treatment in this particular instance. When these last-mentioned oils, which are the light odorous oils that I have spoken of in my direct examination, are submitted to chemical treatment, they lose only the "still smell," but retain their characteristic and peculiar odors.

S. DANA HAYES.

Deposition of Benjamin Silliman, taken before H. Farnam Smith, esq., special examiner, Friday, Nov. 11, 1870.

Direct examination by Chauncey Smith, esq., in behalf of complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Benjamin Silliman; fifty-three years of age; reside in New Haven, Conn.; am by profession a chemist, and have been connected with the chemical department of Yale College since 1837.

Int. 2. To what extent, if at all, have you been accustomed to act as an expert in the examination of chemical inventions or discoveries, and as a witness in suits involving an inquiry into such inventions?

Ans. I have frequently been called upon for technical examinations of the nature described, and have often appeared as a witness in such cases.

Int. 3. How much attention have you given to that branch of chemistry and of the manufacturing arts which relates to the treatment of petroleum and the products obtained therefrom for commercial and industrial purposes?

131 Ans. In 1854, before the discovery of the oil-wells of Pennsylvania, I made careful research upon the crude oil collected in surface pools at Titusville, upon Oil Creek, in Pennsylvania, conducting a series of fractional distillations upon that raw material, the results of which were published by me in a memoir at that time. I then demonstrated the existence in this body (as I believe for the first time) of light naphthas, illuminating oil, lubricating oils, paraffine, and a tarry residuum; in other words, the same class of substances which to-day the oil manufacturer obtains in his treatment of the oils produced from the artesian borings in the same region. I subsequently examined the oil-producing coals and shales of the Ohio Valley and of New Brunswick, while that mode of the oil industry was in the ascendant. I have since lost no opportunity to keep myself informed of the progress of the oil industry, as it has been developed since the discovery of the artesian wells of Pennsylvania.

Int. 4. To what extent have you had brought to your notice the naphthas, light burning oils so called, the heavy hydrocarbons or lubricating oils, so called, and paraffine, as they have been produced by the manufacturers generally in this country for the last eight or ten years?

Ans. I have frequently been consulted by manufacturers with reference to the purification of oils, and have made experiments with a view to the removal from the heavy lubricating oils of the offensive qualities which for a long time interfered so seriously with their general introduction as substitutes for animal and vegetable oils, such as were usually

employed for those purposes. Until a comparatively recent period my own experience in this direction has been that there were great inherent difficulties in the defecation of the heavy hydrocarbon oils, and the results obtained by me and others were only partially successful.

Int. 5. Have you examined the patent granted to Joshua Merrill, dated May 18, 1869, and numbered 90284? If so, will you state how far you consider the description contained in that patent of the character of heavy hydrocarbon or lubricating oils, as generally manufactured previously to the invention described in that patent, to accord with their character as you knew them in the market?

132 Ans. I have read Mr. Merrill's patent, referred to in the question, with care, and I find the description which he therein gives of the heavy hydrocarbon oils, heretofore commonly produced in the practice of the oil distillers, to conform very closely with my own observation and that of chemists generally upon these substances. The patent states that its author does not assume to know why the process which he patents produces heavy oils free from the characteristic odors of hydrocarbon oils previously known, but suggests that these odors arise from matters resulting from decomposition at the temperature at which the heavy oils vaporize and go over, etc. Merrill here expresses, in a modest manner, an opinion, in which I believe all chemists will agree, concerning the reason why these heavy oils have hitherto possessed the offensive character which has distinguished them.

Int. 6. Will you state whether bodies in respect to their odors differ, not only as to their characteristic odors and the degree of pungency of such odors in the mass, but in their power of imparting their peculiar odors to other bodies or of disseminating them through the air, and also as to the degree in which they may be developed and disseminated under special conditions of temperature, or division by friction, or other causes? If so, will you give such illustrations as may occur to you, explanatory of this difference, and then state how the heavy hydrocarbon oils, as known to you previously to your knowledge of Merrill's oil, stand in these respects?

Ans. In answer to your question I would say that, for the purpose under consideration, odors may be classified as being either persistent or diffusive, or, thirdly, as being both persistent and diffusive. Lard oil and sperm oil are familiar examples of bodies having a very persistent odor, highly characteristic of those substances, and an odor which retains, very obstinately, its characteristic peculiarities in each case, even when those oils are very largely diluted with neutral or inodorous substances. In common unrectified kerosene we have an illustration of a body with a very diffusive odor, such as that, when a small portion of such oil is placed in an open vessel, the air of a large apartment is at once impregnated with it to an offensive degree. The odor of musk is another example illustrative of a body possessing both a persistent and a diffusive power in its characteristic odor to a most eminent degree. I find by experiment that a very minute proportion of the light offensive oils

133 distilled off from heavy hydrocarbons, as in following the specifications of Merrill's patent now under consideration, will completely change the neutral character of an odorless oil, imparting to it the offensive and well-known odor inherent in the light spirit before alluded to. Exhibit No. 22 is a sample of Merrill's deodorized oil, to which I have added two per cent. of the offensive spirit distilled off by me from the same oil on the 31st of August, 1870. The odor of this mixture will address itself to the sense of smell, as being identical in character, and apparently almost equal in intensity, to that of the orig-

inal spirit, of which Exhibit No. 20 is a sample. Exhibit No. 23 is a lard oil, to which four per cent. of the offensive spirit of August 31, 1870, has been added. In this exhibit, the persistent, greasy odor of the lard oil is almost completely disguised by the offensive odor of the spirit added. Exhibit No. 24 is a sample of pure sperm oil, to which four per cent. of the same offensive spirit of August 31, 1870, has been added. The characteristic odor of the sperm oil is very nearly disguised or cloaked by the small dose of spirit which has been added. Exhibit No. 25 is produced by the use, as a substratum, of a common commercial falsification of sperm oil, formed by the mixing with it of an equal measure of lard oil, and adding to this mixture ten per cent. of the offensive spirit of August 31, 1870. It requires careful attention to detect, as it appears to me, under this disguise, the characteristic odors of the two animal oil , which form the substratum of this falsification. I have also prepared the following mixtures of fat oils, both animal and vegetable, with neutral or deodorized heavy hydrocarbon oils, viz:

First. $\frac{1}{3}$ sperm oil, $\frac{2}{3}$ Merrill's deodorized oil.

Second. $\frac{1}{3}$ sperm, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Third. $\frac{1}{3}$ castor, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Fourth. $\frac{1}{3}$ cotton-seed, refined unbleached, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Fifth. $\frac{1}{3}$ poppy, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Sixth. $\frac{1}{3}$ almond, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Seventh. $\frac{1}{3}$ olive, so called, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

Eighth. $\frac{1}{3}$ lard oil, $\frac{2}{3}$ Merrill's "29 L." deodorized oil.

In all these mixtures the falsification was complete, the characteristic odor and appearance of the falsified oils being preserved in the mixture. Only in the case of the castor oil was there any disposi-
134 tion to mix perfectly. I have also made various samples of falsified volatile oils, employing for this purpose, as the basis, Merrill's deodorized hydrocarbon oil, and adding to a four-ounce sample of the same, in separate bottles, two or three drops, respectively, of oil of annis-seed, of cassia, of turpentine, etc. This minute quantity of these highly odorous oils perfumed completely the entire mass of the neutral oil employed, producing a good falsification of the several oils in each case. These experiments teach us that if a heavy hydrocarbon oil, containing not more than one or two per cent. of light offensive oils, is employed in a warm apartment, as a lubricator, the atmosphere of such apartment will unavoidably be impregnated by the pungent and disagreeable odors of these volatile products, contained in the oils employed. This serves to explain to us why the heavy hydrocarbon oils employed for lubricating cotton, woollen, and other machinery, prior to the introduction of Merrill's deodorized oil, gave just cause of complaint against the use of such odorous oils for the purposes specified. The odor of the crude oil of Pennsylvania, as it flows from the wells, and prior to any treatment at the hands of the manufacturer, is by no means to be confounded with the pungent, disgusting, and offensive odors imparted to the heavy hydrocarbon oils by the pyrogenic products of destructive distillation. In point of fact, the odor of the natural product is ethereal and not offensive. To some, as to myself, it is even agreeable. Exhibit No. 26 is a specimen of crude oil of Pennsylvania, which is submitted in evidence of the correctness of this last statement.

Int. 7. Have you examined samples of oil purporting to have been sold by the defendants in this case? If so, will you state from whom or where you obtained them, and at what time?

Ans. I have had two samples purporting to be sold by the defendants.

One of them was handed to me by Mr. Joshua Merrill, in July last, if I remember correctly. Another, taken by my colleague in this case, Dr. Chandler, from a cask in possession of the plaintiff in this case, bearing the trade-mark of Dr. Tweddle, the reputed manufacturer. These two samples are identical in physical and chemical properties. Their density at sixty degrees Fahrenheit is thirty-five degrees Baumé. Both are neutral, in the commercial sense of that term—meaning that they are sensibly without odor or taste.

135 Int. 8. Have you made or assisted in making any oil from heavy hydrocarbon oil, such as is mentioned in Merrill's patent, as the material from which he produces his deodorized oil, using the means and following the instructions which he gives in that patent for producing his new oil?

Ans. I have assisted in carrying forward to completion four distinct experiments, designed to meet the varying experimental conditions, which suggested themselves to me as conforming to the letter of Merrill's patent, or as being modifications thereof, such as were legitimate means of performing the same in conformity with the resources of the art as now known and practiced by its experts. I understand that Merrill, in the first place, in his patent contemplates the treatment of the raw material specified by him (namely of hydrocarbon oils or petroleum, from which the light oils, illuminating-oils, tarry matters, and paraffine have been already removed by previous processes of distillation, chilling, expression, etc.) by fire alone. Secondly, that he recommends, by preference, the use of a regulated flow of steam superheated in the manner he describes, and delivered directly into the body of the oil to be distilled after its temperature has been raised to a certain specified degree. And, finally, that he considers that his invention will be used whether the raw material employed has or has not been previously freed from the lighter burning oils and naphthas, paraffine, tarry matters, etc., so long as the said raw material contains the heavy oils the production of which in a neutral or deodorized condition is the essential point of his invention.

Int. 9. Taking the case where you produced the oil for the heavy hydrocarbon oil described in Merrill's patent, by the use of fire and steam in the manner he describes, how did the oil produced compare with the description in his patent of his new oil?

Ans. The product obtained by me in the experiment conducted upon the 31st of August last, upon the raw material, conforming to the specifications of Merrill's patent, was in all respects identical with the product manufactured by him for sale, and which I found existing in the filling-tanks of Downer's Oil Works. The only point of difference noticeable in the two was that the density of my own product was a little less, viz, thirty-two and three-tenths degrees Baumé at sixty Fahrenheit, while the density of the oil in the tanks was thirty-one and one-

136 half degrees Baumé at the same temperature; the density of the product in either case being determined by the point at which the process of distillation is stopped; thirty-two degrees Baumé, in any case, being the conventional standard of Merrill's deodorized oil. The oil which I produced in the above experiment corresponds exactly to that which is described in the plaintiff's patent.

Int. 10. How did the samples which you had of the defendant's oil correspond with the oil described in Merrill's patent as his new oil? How far do you find the two to be alike substantially, or unlike?

Ans. I found as the result of my own experiments in the analysis and comparison of these two oils that they were substantially identical. The density of the defendants' oil is by the hydrometer a little less than that of the plaintiff's oil.

Int. 11. You have spoken of the defendants' oil being neutral to taste and smell. If you made any experiments to ascertain its behavior when mixed with such lubricating-oils as sperm and lard oil, will you state how it compares substantially, when tested in that way, with the oil produced in the manner described in Merrill's patent?

Ans. I have made a duplicate series of the same mixtures of animal and vegetable oils, and of essential oils, using the defendants' oil as the substratum, similar in all respects to the series which I have already enumerated in my answer to the sixth interrogatory, and I believe that no person, however expert he may be in the recognition of mixtures and falsifications of oils, could, without reference to the labels attached to those two series of samples, distinguish the one series from the other. They are, as it appears to me, entirely identical.

Int. 12. You spoke of having varied the means or conditions by which you produced a deodorized oil. Will you state in what respect you varied the conditions in these four experiments?

Ans. The four experiments to which I allude were intended to demonstrate the results of the four following processes: First, Merrill's process, properly so called, employing fire and steam; second, a process by fire alone; thirdly, a process by fire, steam, and vacuum; and fourthly, a process by fire and vacuum without steam. Each of these processes was carried through upon one hundred and forty-eight gallons of the same raw material, and the details thereof and the results obtained
I will state at length, if so desired. The raw material employed
137 in each of the foregoing experiments was petroleum from which all the light oils, meaning naphthas, the illuminating oils, the tarry matters, and the paraffine, had been removed in previous processes. In regard to the character of the products obtained in each of these experiments, it is sufficient to say that they were all, in their essential characters, substantially alike, and like to the product said by the patentee to be obtainable, where the methods described in the patent are practised.

Int. 13. Will you state how the products which were distilled over, as you approached the line of demarcation of this deodorized oil, corresponded?

Ans. They were substantially alike.

Int. 14. Did you make any experiments for the production of the new oil described in Merrill's patent, directly from petroleum, using fire and steam, in the manner described in the patent? If so, will you state at what stage of the process you separated the tarry matter and paraffine, and what was the character of the heavy oil you obtained, as compared with that described in Merrill's patent?

Ans. I understand the question to mean by petroleum that substance remaining after the removal of only the naphthas by steam down to the density of sixty degrees Baumé; if so, my answer is, I did. On the 13th of September last past, I distilled one hundred and forty-eight gallons of crude Pennsylvania oil, as above described, having a density of forty-two degrees Baumé, at sixty Fahrenheit. Fire and steam alone were employed. The distillate was received in a common vessel up to the density of thirty-eight and two-tenths degrees Baumé. At that density the receiver was changed, a little more steam was let on, and the process was conducted as before, until twenty-five gallons of product had been obtained, ending with a density of thirty and six-tenths degrees Baumé. The residuum remaining in the still contained all the tarry matters, while the product of twenty-five gallons, just named, rich in paraffine, was refrigerated at a temperature approaching twenty-six degrees Fah-

renheit for several days, and the refrigerated mass was then compressed in the usual manner for the removal of the paraffine and the separation of the heavy hydrocarbon oil, which was then subjected to gentle chemical treatment, and the product was found to be substantially identical with the heavy deodorized oil of the patentee, but lighter in density, being thirty-six degrees Baumé.

138 The reason for its lesser gravity is that the process was arbitrarily stopped short of the horizon or dividing line, which marks the highest density of the patentee's oil. There was no reason, except in the caprice of the experimenter, why the product might not have been reduced to the density of thirty-two degrees Baumé.

It is well to remark, in this connection, that the experimenter may elect at what point in the progress of the distillations he will separate the paraffine produced in the previous stages of destructive distillation of the petroleum, and also when he will separate the tarry matter always inherent therein. In the last-mentioned experiments I elected to make those separations in the manner already specified, and not in the manner described by Merrill in his patent. But I consider the departure from the specific directions of Merrill, in this experiment, as merely formal, and not essential departures or variations. The resulting product of deodorized heavy oil is in either case substantially saved.

Int. 15. If you varied this experiment by making use of a means for producing a vacuum, in connection with fire and steam, used as before, will you state what result you obtained?

Ans. I did so modify the experiment, distilling upon the 1st of September, 1870, one hundred and forty-eight gallons of crude Pennsylvania petroleum, from which the naphthas had been previously removed by steam, as already described in my last answer, employing an air-pump to produce a partial vacuum, averaging twenty-one or twenty-two inches, perhaps. The distillate obtained under this modification of Merrill's process was carried on until, at the density of thirty-seven and a half degrees Baumé, seventy five gallons of lighter oils had been removed. The recipient was then changed, and the experiment was continued, without further modification, until forty-five gallons of heavy oil had been wafted over, having a density, after treatment, of thirty-three and five-tenths degrees Baumé. The residue or residuum remaining in the still contained, as in the former case, all the tarry products, with a portion of the paraffine. The heavy distillate was refrigerated as before, the paraffine expressed, and the oil subjected to the same chemical treatment as in the last named experiment. The product was, in all respects, substantially identical with that which I had previously obtained, when practising the method described in Merrill's patent. I will remark

139 that the object in view in this modification of the experiment, so far as the employment of a vacuum was concerned, was to determine what, if any, difference there might be in the degree of heat required to complete the process when modified in this particular. I found that the temperature reached at a point of demarcation, or horizon of dividing the light from the heavy oils, was, for the vapor of the oil in the experiment with the vacuum, four hundred and thirty degrees Fahrenheit, and in the experiment of September 13th, before mentioned, the temperature of the vapor at the same point, the divisional line, was four hundred and ninety-three degrees, but the temperature rose before the close of the last fraction, that is, before the whole of the forty-five gallons were delivered, to above six hundred and forty degrees Fahrenheit, and also it should be remarked in this connection that in the process of Merrill, by fire and steam alone, the whole of the

lighter oils were removed from the heavy hydrocarbon oils at a temperature of four hundred and ninety-six degrees Fahrenheit, the oil having at that point a density of thirty-two and two-tenths degrees Baumé.

Int. 16. Why did you obtain a larger quantity of the heavy oil in the latter experiment than in the previous one?

Ans. Because in the previous experiment I did not run the density of the product to so low a point as in the latter.

Int. 17. What was the object of the slight chemical treatment you have spoken of in both cases?

Ans. The object of the chemical treatment was the removal of a certain burned or empyreumatic ordor, familiarly known as the smell of the still, the presence of which would materially impair the value of the product, which, by the very condition of its name, must be a deodorized product.

Int. 18. Did you in those experiments compare the products which you obtained, as the distillations approached the dividing line which you adopted between the light and heavy oils, with each other, and with those which you obtained, at the same stage of the distillation, when following the directions of Merrill's patent?

Ans. Samples of every fraction of five gallons from the commencement to the end of each of the several experiments were saved and preserved for study and comparison; and I found no substantial difference between them, when comparing those of corresponding densities.

140 Int. 19. In your examination of the samples of the oil sold by the defendants did you find anything which would enable you to form a judgment as to whether its neutral character, of which you have spoken, was produced by the manner in which the distillation was conducted, or by chemical treatment after the distillation was ended?

Ans. Without any means of positive knowledge on my part as to the precise method by which the defendants' oil was produced, the conviction was nevertheless forced upon my own mind, as the result of my investigations, that it must have been produced by one or other of the several methods which I have already described, since I know no other method than those by which such a result could be obtained. Nor have I any reason to believe that the chemical treatment to which the defendants' oil may have been submitted subsequent to its distillation was different in kind, or in its results, from that which I have practised. The defendants' oil appeared to me, however, when tested by the usual methods employed by chemists for the determination of acidity, to be slightly more acid than Merrill's deodorized oil, in the sample handed to me by him in July last.

Int. 20. If the defendants' oil had been chemically treated only in the manner in which you treated the oils which you obtained, or in some known manner practised by manufacturers or pharmaceutists, would such treatment have been adequate to remove from the oil the peculiar odor which has been spoken of as being due to the presence of the lighter oils, and give to it the neutral character which it in fact possesses?

Ans. If I understand your question, you refer therein to a product, still holding within it portions of the light oils, resulting from the destructive distillation of petroleum, in the earlier stages of distillation, and the presence of which, in the heavy hydrocarbon oils heretofore known in the arts, prior to the introduction of Merrill's deodorized oil, has rendered them unsuited to the purposes for which a neutral oil is required. With this understanding of the question, my answer is, no.

Int. 21. Will you state whether or not, in your judgment, the experiments performed by you, under various conditions stated, as to the use of fire, steam, and vacuum, and upon the different materials designated as the heavy hydrocarbon oil mentioned in Merrill's patent, crude
141 petroleum, after the removal of the naphthas, should as a process be regarded as substantially the same?

Ans. I think they should. I have already somewhat amplified this answer in my response to the fourteenth interrogatory.

B. SILLIMAN.

Deposition of Alexander Cumnock, taken before H. Farnam Smith, esq., special examiner, Thursday, Nov. 17, 1870.

Direct examination by Chauncey Smith, esq., in behalf of the complainant:

Int. 1. What is your name, age, residence, and occupation?

Ans. Alexander G. Cumnock; age, thirty-six years; residence, Lowell, Mass.; agent of Boott Cotton-Mills.

Int. 2. Will you state how large those mills are, how many spindles and looms are used, and how many operatives are employed?

Ans. Ninety thousand spindles; eighteen hundred and eighty looms; fourteen hundred and fifty operatives.

Int. 3. What kind of oil do you use for lubricating in those mills at the present time?

Ans. We use sperm and Downer's deodorized paraffine oil.

Int. 4. What quantity of each is used per year?

Ans. We use about two thousand to twenty-five hundred gallons of sperm and four thousand to forty-five hundred gallons of paraffine oil per year.

Int. 5. How long have you used the deodorized paraffine oil which you now use?

Ans. A little over two years. I cannot give the exact time.

Int. 6. Will you state whether you use these two kinds of oil separately or mixed; and, if you use them mixed, whether you purchase them separately and mix them yourselves?

Ans. We use the oils mixed. We purchase them separately and mix them ourselves.

142 Int. 7. What price are you paying now for the sperm oil, and what for the deodorized oil?

Ans. One dollar and thirty-seven cents for sperm; fifty-five cents for Downer's deodorized oil.

Int. 8. Will you state in what proportions you mix these oils for your different kinds of machinery?

Ans. On our picking, carding, ring spinning, and mules we mix it half and half; on our warpers and dressing and weaving, three parts of Downer's deodorized oil to one part of sperm; on our shafting we run the Downer's deodorized oil unmixed.

Int. 9. Before you commenced using Downer's deodorized oil had you used any paraffine oils; if so, will you give the names of the manufacturers whose oils you had used?

Ans. We had used the Portland paraffine oil, an oil sold by Seccomb, Kehew and Thayer, and a paraffine oil sold by Charles T. Place, of Providence, R. I., and oil of the Downer Company, and also the oils of a number of manufacturers whose names are unknown to me, and which were purchased through C. B. Coburn & Co., of Lowell.

Int. 10. Have you used any of the oils of these manufacturers whom

you have last named, or of others unknown to you, since you commenced using Downer's deodorized oil?

Ans. No, sir.

Int. 11. Do you find any difference between the deodorized oil which you are now using and the paraffine oils which you used before you commenced with this oil in respect to odor? If so, will you state what it is?

Ans. I do find a difference. In our oil-room, when shut up over night, the odor was so offensive in the morning that the man in charge of the room had to open the doors and windows before he commenced work—I mean with the old oils. With the present oil which we are now using we have no difficulty of that kind. The old oil also affected the eyes of the man in charge. With the new oil there is no trouble of this kind. With the old oil the room was so charged with odor that water would frequently run out of the eyes of a person going in there. I have noticed myself that after going in there my eyes would frequently smart for some time after coming into the air.

Int. 12. By oil-room do you mean the room where the oil was stored, and from which it was distributed?

143 Ans. I do.

Int. 13. Will you state whether or not the odor of the old oils was found objectionable in the rooms where the oil was used, and how it compared with the new oil in that respect?

Ans. The old oil had a very bad odor. Now there is no perceptible odor.

Int. 14. How was it with the old oil in respect to staining goods or clothing with which it came in contact, and in respect to charging the clothing of the operatives with its odor?

Ans. We had frequent complaints from the bleachery in regard to the goods being stained; so much so that we increased the quantity of sperm at times to avoid the difficulty. We had frequent complaints from the operatives of the odor of the oil imparted to their clothing; so much so that parties on the street passing them could smell it very readily.

Int. 15. Will you state whether there is any difference between the old oil and the new, either in respect to the staining of the goods or to the odor, and whether or not you have the same complaints?

Ans. We have had no complaints for two years in regard to staining the goods at the bleachery; nor have we had any complaints from the odor on clothing.

Int. 16. If you have found any difference between the new oil and the old, when mixed with the same proportions of sperm oil, as to the length of time which the machinery would run with one oiling under any circumstances, will you state what it is?

Ans. We have found a very great difference. On our spinning, where we mixed our oil half and half, we had frequent complaints that the oil was poor, especially in June, July, and August. When we had these complaints we increased the quantity of sperm to three of sperm to one of the old; I mean the old Downer oil. Last summer we run the entire summer without complaint of any kind, with half and half, half sperm and half Downer's deodorized.

Cross-examination by Causten Browne, esq.:

Cross-int. 1. Referring to the staining, of which complaints were made at the bleachery, what caused this, if you know?

Ans. The bleachers said it was using paraffine oil at the mill.

144 Cross-int. 2. Do you know why this staining happened with what you call the old oil, and not with the deodorized oil?

Ans. No, sir.

Cross-int. 3. Do you know, of your own knowledge, and from your own examination, that there is any difference in this matter of staining between the goods made by machinery lubricated with the old oil, or machinery lubricated with the new?

Ans. I have no means of knowing except what information I received from the bleachers. The fact that we have used the paraffine oil in larger quantities in our weaving department leads me to believe that the goods can be bleached satisfactorily and use Downer's deodorized oil.

Cross-int. 4. What sort of stain was it that was found on the goods in the bleachery?

Ans. After the goods were bleached there was a yellow spot, where the oil was dropped on the goods in the brown. The staining was owing to the accidental dropping of the oil on the woven goods by the party engaged in oiling the machinery.

Cross-int. 5. Do you know whether these spots would wash out?

Ans. I have tried to wash the oil out myself with soap and water, but could not do it. It left a black or dark stain, darker than the original color of the oil.

Cross-int. 6. How long have you used in your mills the Downer old oil, so called?

Ans. Some four or five years.

Cross-int. 7. You speak, I suppose, of the years just preceding the adoption of the new oil?

Ans. I do.

Cross-int. 8. When did you use Seccomb, Kehew & Thayer's oil; before or after you began to use Downer's old oil?

Ans. We used it at the same—in the same years. We bought of different parties.

Cross-int. 9. Did you get the Seccomb, Kehew & Thayer's oil direct from them?

Ans. We did.

Cross-int. 10. Comparing the last year of your use of the Downer old oil and your first year of your use of the new oil, in which of

145 those two years did you use the greater quantity of paraffine lubricating-oil in the Boott Mills?

Ans. The first year of the new oil we used the greatest quantity of paraffine. I am unable to say how many gallons more. We used one-fourth more on the spinning machinery during the summer months than during the same months of the preceding year.

Cross-int. 11. Why do you use the Downer's deodorized oil unmixed on your shafting, and not on the other parts of the machinery?

Ans. Because we find that Downer's oil works satisfactorily on shafting without mixing.

Cross-int. 12. Why do you mix it for use on the other parts of your machinery?

Ans. Because we get a more satisfactory lubricator.

Cross-int. 13. In what respect more satisfactory?

Ans. It gives us a heavier-bodied oil, and we think, as practice proves, that it has a greater lubricating quality than when used alone.

A. G. CUMNOCK.

Mr. Browne, in behalf of defendants, agreed that this deposition might be filed and used as though taken within the time fixed for the taking of plaintiff's testimony.

146 TESTIMONY FOR THE RESPONDENTS.

Deposition of Wm. C. Chapin, taken, subscribed, and sworn to before N. Austin Parks, esq., special examiner, Jan. 18, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Wm. C. Chapin; residence, Lawrence, Mass.; age, fifty-three years. I am agent of the Pacific Mills, Lawrence.

Int. 2. How long have you been agent of those mills?

Ans. About eighteen years.

Int. 3. What is the manufacture of goods at those mills?

Ans. Cotton goods and mixed cotton and worsted goods—both plain and figured.

Int. 4. State how many spindles are run in the Pacific Mills, and how many hands employed.

Ans. About 130,000 spindles, and about 3,600 people.

Int. 5. How do the cotton and worsted goods manufactured by the Pacific Mills rank, as to fineness of grade, for such goods?

Ans. We make fine yarns and coarse yarns, no very coarse yarns.

Int. 6. Was there at any time used in the Pacific Mills for lubricating bearings a paraffine oil known as the Maysville oil?

Ans. Yes.

Int. 7. About how long was it used, and when did its use cease?

Ans. I should think it was used three or four years. I should think the cessation was in 1868. From 64 to 68 (I can't tell exactly) was the time in which it was used, as near as I remember.

Int. 8. From what material was the Maysville oil made?

Ans. From cannel-coal, mined in West Virginia.

Int. 9. As regards the body, color, and odor of this oil, did it improve or deteriorate in each successive year that it was produced?

Ans. I do not know of any change in the body of the oil in that time. The color was made lighter. I knew of no change in the odor.

147 Int. 10. Why was the use of this oil at the Pacific Mills stopped in 1868?

Ans. Because of the cessation of the manufacture of this oil, because of the inability to make it with sufficient economy to compete with, so called, earth oil, or petroleum. I speak, of course, of what I understand from the parties.

Int. 11. Did you use any other oil for lubricating during the years that you used the Maysville oil; if so, what?

Ans. We used Cooper's neat's-foot oil. I remember no other now.

Int. 12. Had you previously to using the Maysville oil used sperm oil for lubricating?

Ans. We had.

Int. 13. Have you so used it since you began to use the Maysville oil?

Ans. Only in very small quantities.

Int. 14. For all the purposes of a lubricator in your mills, which have you found to be the better oil, the Maysville oil or sperm oil?

Ans. That's a hard question. We should choose the Maysville oil as

then manufactured to sperm oil as it now can be bought, meaning by that to express a want of confidence in the purity of sperm oil.

Int. 15. Take the last year that the Maysville oil was manufactured, say 1868, and comparing it with the sperm oil which was in the market at that time as a lubricating oil, was either of these two oils preferable to the other for the general purposes of a lubricator such as your mills required; if so, which?

(Objected to.)

Ans. It is self-evident that we preferred the Maysville oil.

Int. 16. Did you prefer it partly by reason of its comparatively low price, or did you prefer it with reference solely to its merits as a lubricator?

Ans. The price influenced us considerably, yet we were satisfied that the Maysville oil was preferable to sperm as a lubricator.

Int. 17. In what particulars did this superiority as a lubricator consist? Will you explain briefly wherein it was better than sperm?

Ans. We found that we used no more quantity of the Maysville oil than of the sperm, and without careful practical tests were satisfied that we used no more power when employing Maysville oil as a lubricator than when using sperm oil for the same purpose.

148 Int. 18. As regards the use of the two oils on what would be called small bearings, was there any special advantage or superiority observed in the use of the Maysville oil over the sperm oil; and, if so, what?

Ans. We preferred the Maysville oil for such uses because of the conviction that its efficiency was more permanent.

Int. 19. Would the greater proportion of bearings in your mill be classed as small or as large bearings?

Ans. As small bearings.

Int. 20. Take the last year or two of the production of the Maysville oil and state whether any objection was found to exist against it in the Pacific Mills as regarded its body, its color, or its odor.

Ans. No general objection. Individuals might complain of the body and of the odor.

Int. 21. What was done, if anything, on account of these complaints, if there were any such?

Ans. Nothing at all.

Int. 22. Why not?

Ans. It was not considered of importance.

Int. 23. Was any trouble found in the Pacific Mills from the Maysville oil staining the goods at any time; if so, how was this trouble provided for?

Ans. We had no trouble of any consequence.

Int. 24. Did you have any stains which were not removed by proper bleaching?

Ans. I do not remember any.

Int. 25. As the Maysville oil first came to you from the works, was it pure or mixed with fatty oil?

Ans. It was undertood to be mixed.

Int. 26. How was it in the last year of its production and supply to you—did it come pure or mixed?

Ans. Generally unmixed.

Int. 27. And was it used unmixed?

Ans. Sometimes it was used unmixed.

Int. 28. Throughout the mill?

Ans. I think so.

Int. 29. When so used unmixed, how was it found to operate, satisfactorily or otherwise?

Ans. Satisfactorily.

149 Int. 30. What was the average annual consumption of the Maysville oil, as a lubricator, during the years it was used, as near as you can state?

Ans. I think about 5,000 gallons annually on the average.

Cross-examination by Walter Curtis, esq.:

Cross-int. 31. You know a good deal about lubricating oils that have been used during the past fifteen years, do you not?

Ans. Very many kinds of lubricating oils have been presented to my attention for purchase and use during the last fifteen years. I have sought to know about them as far as I could.

Cross-int. 32. Won't you please tell us what you know about them generally and what you know about each specific kind?

Ans. Sperm oil has been used under my supervision for many years. I believe that I know it to be a good lubricator, from direct personal observation. I will say the same of Cooper's neat's-foot oil; of the Maysville oil; of the Portland oil, so called; of the Downer & Co. oil; of Libby & Clark's oil; of the oil manufactured in Salem by Seccomb & Co.; of the oil manufactured by the Binghampton Oil Co.

Cross-int. 33. You consider all the oils you have named as good lubricators, and put them in the same category then, do you?

Ans. I consider them all good lubricators, but experience does not indicate them to be of corresponding value.

Cross-int. 34. Please point out what your experience has indicated to be their respective values, and why you place the respective values as you do, stating fully all you know about each of the oils you have named, except that it is a lubricating oil and used for that purpose successfully.

Ans. In trials of different oils, experiments were made under my own direction by parties in my employ. The result of those trials has given me the basis for my judgment, but minute particulars concerning each oil, I cannot give here.

Cross-int. 35. Please hear the 32d and 34th interrogatories read again, and state whether you have answered them to the best of your ability. If so, that is all I desire.

Ans. It was my intention so to do.

Cross-int. 36. You have spoken of an oil termed the Maysville oil, made from cannel coal; please state where you bought that oil and whom you bought it from.

150 Ans. We bought it of Bailey & Eaton, of Boston; also of the Union Coal & Oil Co., of Maysville, Kentucky.

Cross-int. 37. Were the last-named persons the manufacturers of the oil?

Ans. So reported.

Cross-int. 38. I understand you to have testified that you used Cooper's neat's-foot oil at the same time you were using the Maysville oil; what proportionate quantity of the neat's-foot oil did you use as compared with the Maysville oil?

Ans. During the early portion of this time, from 1864 to 1868, probably three-quarters of our consumption was of neat's-foot oil. This proportion was gradually reduced until it did not exceed from two to five barrels per month.

Cross-int. 39. How did the Cooper's neat's-foot oil used by you compare in price with the sperm oil at the same dates?

Ans. Usually twenty-five cents per gallon less; sometimes the difference was a little greater.

Cross-int. 40. So far as you know, is it the opinion of the users of lubricating oil that there is any better lubricator than good sperm oil for use on general machinery?

Ans. I believe the general conviction among consumers of oils for lubrication is that first-quality sperm oil is the standard.

Cross-int. 41. Did you ever make any careful practical tests as to the amount of power required when using Maysville oil as compared with that required when using sperm?

Ans. No careful practical tests.

Cross-int. 42. Then you don't know anything about it with any positiveness, do you; if anything, what?

Ans. I know that at the times when using sperm oil for the same amount of machinery as when using Maysville oil there was no such perceptible difference in the opening of the gates for the inlet of water upon our turbine water-wheels as to show that a larger amount of power was required for one above the other, and this test I consider of as good practical use in large mills as the dynamometer.

Cross-int. 43. What part of your business, as agent of the mills, is it to ascertain what the opening of the gates for the inlet of water for the turbine-wheels is precisely?

151 Ans. It is my business to understand as far as possible minutely the economy of the entire manufacture; and a knowledge of the amount of water used, for which we pay, is a part of that economy; and the position of the gates referred to is not only a subject of frequent personal observation, but of more frequent report to me by the parties in charge.

Cross-int. 44. I understand you to have testified that, after you gave up using sperm and used Maysville oil instead, you used about the same quantity of Maysville that you had of sperm before you began to use Maysville. Am I correct in so understanding you?

Ans. I think not.

Cross-int. 45. What were the facts, then, in this respect?

Ans. I believe that, from either the real character of the coal-oils, so called, including the Maysville, or from increased intelligence in the application of the oils, much more of sperm oil wa s used to lubricate the same amount of machinery. I mean to convey the idea that experience leads me to the conclusion that a less quantity of these oils than of the sperm serves the purpose equally well.

Cross-int. 46. Do you know of other parties beside yourself in this vicinity who bought this Maysville oil?

Ans. I have no general information upon the subject, but believe that the Naumkeag mills of Salem used this oil, but do not now recall any others.

Cross-int. 47. You have stated, I believe, that you had little or no trouble from the staining of the goods while using the Maysville oil. Didn't you, while using that oil, resort to a new process of bleaching peculiar to yourselves for the purpose of removing the staining of the goods?

Ans. We did not.

Cross-int. 48. Haven't you, at any time, used a process peculiar to yourselves to avoid the difficulties you met with from this class of oils?

Ans. No different process from that used when employing sperm oil as a lubricator, nor any different process from what we should now use if we returned to sperm oil.

Cross-int. 49. Do you mean to testify, or not, that the staining ever troubled you and that you ever had any difficulty in bleaching the goods out?

Ans. We never had any difficulty in bleaching cotton goods
152 manufactured while using coal oils for lubrication. We have had some worsted goods, to a small extent, which were supposed to be injured by spots of these oils, but have never had serious trouble, even with this class of goods. In this class staining is more objectionable than in cotton goods because of the higher value and the greater difficulty of removing any stains from worsted goods.

WM. C. CHAPIN.

Deposition of George F. Whiting, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, Jan. 18, 1871.

Direct examination by Causten Browne, esq., counsel for respondent:

Int. 1. State your name, age, residence, and occupation.

Ans. George F. Whiting; age, 42; residence, Chelsea, Mass.; I am an oil-dealer, doing business in Boston.

Int. 2. How long have you been in the oil-business and in what classes of oils have you dealt?

Ans. About six years. I have dealt in paraffine oils mostly.

Int. 3. What was your last employment, previous to those six years?

Ans. For a period of three years I was a manufacturer of vinegar.

Int. 4. Where and with whom were you employed for the three years ending in 1868?

Ans. By Bailey and Eaton, 28 Canal st., Boston.

Int. 5. What was their business during that time; what paraffine oil were they selling and where and from what was it manufactured?

Ans. They were agents for the sale of the products of the Union Coal and Oil Co., of Maysville, Kentucky. The oil was manufactured from coal, cannel-coal, mined in West Virginia, and was known as the Maysville oil.

Int. 6. Was this Maysville oil produced after 1868?

Ans. It was not.

Int. 7. During the last three years that it was produced did it improve from year to year in body, color, and odor or otherwise?

Ans. It did improve.

Int. 8. How did it compare, say in the last year of its produc-
153 tion, with other paraffine-oils, then made, as regards the degree of the pungent odor said to be characteristic of such oils?

Ans. It has less odor than any oils with which I was acquainted.

Int. 9. During the last three years of its production how many barrels, on an average, were produced and sold annually?

Ans. I have no means of knowing the exact number, but should judge several thousand.

Int. 10. How was the demand from year to year during those three years; stationary, increasing, or decreasing?

Ans. I should say that it gradually increased.

Int. 11. To what kind of mills was this Maysville oil sold during those three years for use as a lubricator?

Ans. To cotton-mills mostly; some woolen-mills.

Int. 12. Were any complaints received in regard to the body, the color, or the odor of these oils?

Ans. No general complaint; it was very rarely that we heard a complaint.

Int. 13. What was the gravity of that oil at 60° Fahrenheit?

Ans. About 26 Beaumé.

Int. 14. At what price was it sold to consumers during the last three years of its production; and how did such price compare with that of the Portland oil, so called, in market at the same time?

Ans. The price ranged from sixty-five to eighty cents per gallon. The price was somewhat higher than that of the Portland oil.

Int. 15. You say it was very rarely that you heard a complaint in regard to the Maysville oil. When you did hear a complaint; what was it about?

Ans. It would be either about the lubricating quality or the color.

Int. 16. Did these complaints prove to be founded in fact?

Ans. They were generally found to result from prejudice in regard to the use of paraffine oils.

Int. 17. Was this Maysville oil sold to the consumers in a pure state or mixed with fatty oils?

Ans. It was sold in both conditions.

Int. 18. When mixed with fatty oils, what proportion of the Maysville oil did the mixture contain?

154 Ans. From two to three parts Maysville to one of fatty oil. That is, we used from one-fourth to one-half of fatty oil, the rest Maysville.

Int. 19. When sold unmixed, was it for use unmixed?

Ans. In some cases it was; in other cases the customers mixed it.

Int. 20. For all the purposes of a good lubricating oil, how would the Maysville oil, after it reached its best stage of manufacture, compare with the most approved paraffine oils for lubricating, which are now in this market?

Ans. I think the oil would give more general satisfaction than any other oils with which I am acquainted.

Int. 21. Why did the production of this Maysville oil cease when it did?

Ans. On account of the high cost of its production, petroleum having been introduced at much lower price.

Int. 22. Do you mean that crude petroleum was introduced for the manufacture of paraffine oils in 1867 or 1868?

Ans. No, sir. I do not know exactly when crude petroleum was introduced; but in our trade the competition was greater during the last two or three years of the manufacture of the Maysville oil.

Int. 23. You do not know, do you, how long the Maysville oil was manufactured before your connection with it?

Ans. I do not.

Cross-examination by Walter Curtis, esq.:

Cross-int. 24. How much knowledge had you with regard to the affairs of the Union Coal & Oil Co., of Maysville, and of the processes used at different times while you were at work for Bailey & Eaton—by that company—in the manufacture of their oils?

Ans. I have never visited their works while in operation, and know very little about the process of manufacture.

Cross-int. 25. Do you know whether or not that company failed in business in 1868?

Ans. I do not.

Cross-int. 26. Do you know whether they failed at any time?

Ans. I do not.

Cross-int. 27. Did you understand that that company were making their oil at a profit from your connection with the sale of it, or not?

(Objected to.)

155 Ans. I should say that they were not.

Cross-int. 28. Did you at any time make sales to the gentleman who has last testified, (Mr. Chapin?)

Ans. The company that employed me did make sales to the Pacific Mills, of which he was agent.

Cross-int. 29. Do you know whether or not Mr. Chapin was interested in the Union Coal & Oil Co.?

Ans. I do not.

Cross-int. 30. Do you know whether or not the Union Coal & Oil Co. varied their process of manufacturing during the latter part of the time that they continued in business?

Ans. I do not. I only judged from the improvement of the oil that they had changed it.

Cross-int. 31. Do you know whether or not, some time during the last year or the year before the last that that company continued in business, a man named Atwood was sent out there to try to improve it?

Ans. I have no knowledge of the fact.

Cross-int. 32. You have stated, I believe, that the annual production you understood to be several thousand barrels. Do you mean several thousand barrels of lubricating oil or of all kinds of oil?

Ans. Of all kinds. I should say that there were several thousand barrels of lubricating oil per annum. They also made other oils.

Cross-int. 33. You have testified that the high cost of production was what you understood to be the reason why the company stopped. Do you know whether the company owned their mine or not?

Ans. I think they did.

Cross-int. 34. Do you know what their liabilities for producing the coal from that mine were?

Ans. Of my own knowledge, nothing.

Cross-int. 35. In speaking of the cost of production, did you mean the cost of making the oil after the coal was produced or of obtaining the coal, or both?

Ans. Both together, with the cost of transportation from the mine to the refinery at Maysville.

Cross-int. 36. Can you state any specific facts as to what the cost of the transportation of the coal from the mines to Maysville, and of producing the oil at the works in Maysville or of mining the coal, was?

Ans. I cannot.

156 Cross-int. 37. What oils do you now sell in your present business?

Ans. I sell paraffine oil, but neither Downer's nor Tweddle's.

Direct resumed:

Int. 38. (De bene.) You stated that you should say that the Union Coal and Oil Company were not making their oil at a profit. Whatever your knowledge upon this subject may be, do you speak of the time before or after the introduction of paraffine oils made from petroleum?

Ans. After the introduction of paraffine oils made from petroleum.

GEO. F. WHITING.

Adjourned to 25th inst., at 10 a. m.

Deposition of David M. Yeomans, taken before N. Austin Parks, esq., special examiner, January 18, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. David M. Yeomans; age, 32 years; residence, Boston, Mass.; occupation, oil-dealer.

Int. 2. Are you one of the defendants in this case?

Ans. I am.

Int. 3. Did you begin to deal in the Tweddle oil, so called, sold here by the agent of Dr. Tweddle, of Pittsburg, before or after you dealt in the Merrill deodorized paraffine oil, so called, manufactured by the Downer Kerosene Company? When I say "you" I mean your firm.

Ans. After.

Int. 4. What was the occasion of your ceasing to deal in the Merrill oil and taking up the other?

Ans. I considered the Tweddle oil superior to the Merrill at that time.

Int. 5. At what time was this?

Ans. I can't give the date. It was some time in '68 or '69. I could tell by reference to my books.

157 Int. 6. State fully what were the points in which, at this time, you found the Merrill oil inferior to the Tweddle oil.

Ans. Mainly in my own judgment. The body I considered better in the Tweddle oil, and thought it best for the purpose for which I used it.

Int. 7. Which had the less petroleum-odor, if either?

Ans. I don't consider that either had any of the odor of petroleum.

Int. 8. Had either of them any distinctive smell more strongly than the other?

Ans. The Tweddle oil had more of an odor. I couldn't call it distinctive, because I couldn't classify it. It was a peculiar sweet odor. I can hardly describe it.

Int. 9. What price were you then paying for the Merrill oil and what price did you pay for the Tweddle oil when you took it, as you have said, in preference to the Merrill?

Ans. I cannot tell without reference to my books.

Int. 10. Which of the two was the higher priced, if you can state?

Ans. We either paid more or the same price for the Tweddle oil. We have paid more at times for the Tweddle and the same price at times.

Int. 11. I wish you to refer to the deposition of Mr. Joshua Merrill, answers 16 and 17 of his testimony-in-chief, and say if you remember the meeting between you there referred to, and whether that was the time, or about the time, when you began to deal in the Tweddle oil, as you have described.

Ans. I do remember the meeting. That was about the time, July, 1869.

Int. 12. Has Mr. Merrill correctly stated what passed between you as far as it goes; and if you said anything more to him about the Tweddle oil, what was it?

Ans. He has. I also said to him that I thought it was better than his.

Int. 13. You speak of the inferiority of Merrill's oil to Tweddle's at the time in question, July, '69. Has the Merrill oil improved since that time, and in what respect?

Ans. I think it has; in general superiority over the old; in regard to color principally.

158 Int. 14. As the Merrill deodorized oil was first made, did you find it mixed with any foreign substance; and, if so, what was it, and what was accomplished by mixing it?

Ans. I always supposed it was mixed with what the Downer Co. or Mr. Merrill termed Trinidad oil. The object was to lower the specific gravity or increase the body.

Int. 15. Did you find from any observations of your own that there was resin or some such substance present in the Merrill oil, as first manufactured? If so, state all you observed or ascertained that led you to form the opinion that it was so adulterated.

Ans. My opinion was formed wholly from the peculiar color or shade and the taste, which corresponded with the color and taste of the Trinidad oil, or resin oil.

Int. 16. Will you here state what practical experience you have had, generally speaking, and what length of study you have given in this whole matter of the production of hydro-carbon oils, either from petroleum, from coals, or shales?

Ans. My experience in the use of them has been since 1862 or 1863. By use, I mean the sale of them. My experience has been in my general acquaintance with the manufacturers of the oils. I have given a great deal of study to the matter to get the best oils for my trade. I have been a producer and a manufacturer of petroleum in Pennsylvania and Ohio. I have been a refiner of petroleum in Massachusetts. I have visited a great many of the oil-refineries of the country, have seen nearly all of the paraffine oils produced in this country and in Great Britain. My general knowledge of the production of paraffine oil has been derived from visiting paraffine-oil works and conversing with the various manufacturers.

Int. 17. Mr. Hayes, an expert in this case, for the complainant, says, in his 51st answer of cross-examination, "In the common petroleum of this country, such as comes from Pennsylvania, for instance, there is no paraffine. Paraffine is a product of the destructive distillation of petroleum." State what you know, if anything, from your own observation, going to show whether this is correct or not.

Ans. I think Dr. Hayes is wrong. In producing petroleum the wells often become choked with a substance resembling paraffine. The common term used in the oil-regions for that substance was paraffine.
159 I have gathered handfuls of it from the pipes, and should call it paraffine-wax. The Smiths' Ferry oil, so called, produces greater quantities of that than any other I have seen produced in that way. That may be more perceptible from the fact that the color of that oil is light amber when produced. I mean there may be no more there than in other oils, but it may be more perceptible from that fact.

Int. 18. As the term "heavy hydro-carbon oil" is used in the oil-trade, what does it imply, as to the presence or the absence of the naphthas and illuminating oils, so called?

Ans. It implies not the entire absence, perhaps, but that the naphthas and illuminating oils have been removed or intended to be removed from them.

Int. 19. Can you state, from your practical knowledge of the paraffine-oil business, whether or not the paraffine oils, so called, which were produced before Mr. Merrill's alleged invention, varied considerably from one another in the perfection with which they were manufactured, as regards their body, their color, and their petroleum smell?

Ans. They did.

Int. 20. How did the paraffine oil manufactured by the Downer Kerosene Co. previous to Merrill's alleged invention rank in these respects among the paraffine oils made up to that time?

Ans. It ranked among the first class.

Int. 21. Did the paraffine oils produced at the time inquired of by the same manufacturer vary from year to year, or from lot to lot, in the particular to which I have referred?

Ans. I can't say that they varied, although the same manufacturer put various grades of oil upon the market; but there were manufacturers that always gave me a uniform oil when I asked them to do so, and paid them a price which would warrant their doing so.

Int. 22. You speak of an uniform grade of paraffine oil as obtainable, by paying a corresponding price, prior to the date of Merrill's invention; do you mean that you had to pay a higher price to procure a uniform grade of oil; if so, why was this?

Ans. We did. We were told by the manufacturers of the oil that a uniform grade could only be made by what they termed double distillation.

160 Int. 23. Did a double distillation improve the qualities of the oil, as a general rule, as to body, color, and odor?

Ans. It did.

Int. 24. Did the character of the paraffine oils, as regards body, color, and odor, depend considerably upon the care and skill with which the process of manufacture then commonly used for producing such oils was carried on by the different manufacturers?

Ans. So far as my knowledge goes, it did.

Int. 25. Did it depend, so far as you know, upon anything else? If so, what?

Ans. I don't know that it did.

Int. 26. Between the time when paraffine oils first began to be made in this country for the market and the year 1868, was there or not a gradual improvement going on in the character of the paraffine oils, as regards their body, color, and odor?

Ans. There was.

Int. 27. Due to what?

Ans. To the demand for a better grade.

Int. 28. Between what prices to the consumer did the paraffine oils in the market just before Merrill's alleged invention range, according to quality?

Ans. I should say from forty to seventy cents.

Int. 29. It is testified by Mr. Joshua Merrill that the Downer Co.'s sales of the Merrill's deodorized oil in 1868 were 276,222 gallons, and in 1869 465,290 gallons; also that their sales of the Downer paraffine oil in 1867 were 106,125 gallons. State, if you know, any facts tending to explain this increase of business in the years '67, '68, and '69, including your knowledge of the general development of the paraffine-oil business during those years.

Ans. I should say that the increase of their sales was due wholly to the manufacture of their deodorized oil and their knowledge of the wants of the different markets in which to place it. At the time of their introduction of this oil we were demanding of the manufacturers of paraffine oil an oil free from all petroleum-smell. We wanted that oil to adulterate fatty oils. I also know that there was a similar demand in Europe for the same purpose. Being in England in 1867, I was asked by large oil-dealers there if there was any petroleum oil produced

161 in America which could be mixed with fatty oils to the advantage of the seller or mixer, pecuniarily, which would make a mixture that the consumer would be deceived by or one which he could not discover from the original fatty oil. These English parties claimed that if I could produce such an oil the sales in their country would be very great. I frequently requested Mr. Merrill and others to produce such an oil, telling him where and for what purpose large sales of it could be made both in England and in this country. From that fact, and from the fact

that he had visited Europe himself about this period, and knew exactly where to offer his oils, I attribute the increase of their sales.

Int. 30. Was there or not, in the year '67, '68 and '69, an increased paraffine-oil business generally in this country; and, if so, how considerable an increase?

Ans. There was a considerable increase, but not of any great extent; the smallness of which increase is due in part to the fact that, for many purposes for which we were selling paraffine to take the place of high-priced fatty oils, the decline of fatty oils and the introduction to a great extent of so-called West Virginia or native oils, as distinguished from manufactured oils, allowed them to be substituted.

Cross-examination by Chauncey Smith, esq., counsel for complainants:

Cross-int. 31. You have spoken of having some experience in the manufacture of petroleum oils; will you state a little more fully what the extent of that experience was and what oils you produced while engaged in the manufacture?

Ans. My experience was only as part owner of the Maverick Oil-Works at East Boston. We manufactured the so-called refined oil, or kerosene, and naphthas. We also produced by filtration a light-colored lubricating oil. This was produced from the so-called native oil.

Cross-int. 32. When was this?

Ans. In 1866 and the winter of '66 to 67.

Cross-int. 33. Did you personally superintend or conduct the manufacture of the oil, as a practical man?

Ans. No, sir.

Cross-int. 34. Did you produce any lubricating oil from the oils which you distilled or refined, excluding the native oils which you filtered?

Ans. During my interest in this factory—I mean my part own-
162 ership—we did not; but previous to that time I was selling agent for the same factory, or refinery, and we produced a small quantity of lubricating oil by distillation.

Cross-int. 35. About the time you have mentioned—that is, 1866—did not railroad-companies and some machinists commence using the native petroleum oils as they come from the wells for lubricating, and has not such use of those oils continued to a very considerable extent to the present time?

Ans. They did commence about that time and have continued to a very large extent.

Cross-int. 36. Did not this use of the native oils interfere very considerably with the use, or increase of the use, of the manufactured heavy hydrocarbon oils for lubricating?

Ans. It did.

Cross-int. 37. The lubricating oils which you produced while interested in the Maverick Oil-Works were not distilled at all, as I understand you, but were simply filtered?

Ans. They did not come under the head of distillation, but were heated to a considerable degree, which somewhat changed the nature of the oil.

Cross-int. 38. Through what were they filtered and what was the object of the filtration?

Ans. They were filtered through animal-charcoal or burnt-bone dust. The principal object was to decolorize the oil from a dark green to as near white as we could get it. We also had in view the purifying of the oil from all water and sediment.

Cross-int. 39. The heating was for the purpose of rendering the oil

more fluid, I suppose, in order that it might pass through the filters more readily?

Ans. That was the principal object; yet we heated it to a point where we supposed we evaporated a small part of the light products from it.

Cross-int. 40. The naphthas, I suppose?

Ans. Yes.

Cross-int. 41. And after you had subjected these oils to this process of filtration they were used wholly or mainly for the same purposes as the native oil as it came from the well, were they not?

163 Ans. No, sir; they were not.

Cross-int. 42. For what purpose were they used?

Ans. To take the place of fatty oils for cotton and woolen mill use.

Cross-int. 43. When did you first become acquainted with Merrill's dedorized oil?

Ans. I can't give the exact date; I think in 1868.

Cross-int. 44. Who first showed it to you?

Ans. As near as I remember, either Wm. or Joshua Merrill.

Cross-int. 45. Do you recollect Mr. Joshua Merrill's showing it to you either the first time or at some subsequent time, and your having a conversation with him as to its character?

Ans. I recollect having had several conversations with him in regard to it, and recollect his showing it to me, but can't tell whether it was the first time or subsequently.

Cross-int. 46. Do you remember what opinion you expressed to him, if any, about the character of this oil as compared with the lubricating oils you had previously known in the market?

Ans. I remember telling him it was superior to others in odor and color and that he was on the right road, meaning to refer to former conversations, telling him that the odor was satisfactory, but that the color was not so, for the purpose for which we wanted to use it.

Cross-int. 47. What was that purpose?

Ans. Mixing with fatty oils.

Cross-int. 48. What peculiarity or characteristic of the color did you refer to?

Ans. A blue shade.

Cross-int. 49. When you spoke of Mr. Tweddle's oil as being better in respect to color than Merrill's oil, did you refer to this characteristic of the color?

Ans. I did.

Cross-int. 50. What importance did you then or do you now attach to that peculiar characteristic of the color of oil?

Ans. It is of considerable importance to us, from the fact that we can't mix it to deceive the consumer.

Cross-int. 51. When Mr. Joshua Merrill first talked with you about his oil, or at some time subsequent to that, did you not tell him that

164 the oil was entirely different from any oil you had seen before, and that it was a new article?

Ans. I do not remember stating it to him in those words. I remember telling him that it was superior to anything of the paraffine-oil nature that I had ever seen before.

Cross-int. 52. Did you not say to him substantially what I asked you in the preceding question?

Ans. Well, it may have been substantially so. It was different, and it was new, and I told him it was superior, as I said before, to any other paraffine-oil that I knew of.

Cross-int. 53. You have spoken of the Trinidad oil, manufactured by

Mr. Merrill or the Downer Oil Co. Haven't you purchased that article largely of the Downer Oil Co.?

Ans. We have purchased considerable of it.

Cross-int. 54. You have purchased it pure, that is, unmixed with other oils, have you not?

Ans. We understood it to be so.

Cross-int. 55. When did you first see that article or know of it?

Ans. I think it was in 1868, but would not be positive. It is possible it was in '69.

Cross-int. 56. Was it before or after you became acquainted with the deodorized oil?

Ans. I think it was after.

Cross-int. 57. Did you ever purchase of the Downer Oil Co. any oil which they sold you avowing it to be a mixture of the deodorized oil with the Trinidad oil?

Ans. No, sir; I did not.

Cross-int. 58. I understood to say, in your direct examination, that when you first purchased the deodorized oil of the Downer Oil Co. it was mixed with the Trinidad oil. When were those purchases made?

Ans. I said I supposed it was mixed with Trinidad or resin (sometimes called French) oil. I had no facts to base my supposition on only my own judgment. We made the purchases in '68 and '69, I think.

Cross-int. 59. What led you to suppose that the deodorized oil was mixed with either Trinidad oil or resin oil?

165 Ans. The color and taste.

Cross-int. 60. Did you ever say anything to Mr. Merrill or to any member of the Downer Oil Co. about it, to know whether it was so or not?

Ans. I think I have asked them the question. I should say it was William Merrill.

Cross-int. 61. What answer did you get?

Ans. A denial of it.

Cross-int. 62. When you commenced dealing in the Tweddle oil, what arrangement did you have with him respecting the sale of it?

Ans. No arrangement, at first.

Cross-int. 63. If you afterwards made any special arrangement with him, state what and when it was.

Ans. The arrangement was that we should have the entire sale of New England excepting the city of Providence, and it was made very shortly after our first purchases—I should say within three months. That arrangement is only in force in part now.

Cross-int. 64. Was not this exclusive agency an inducement to you to deal in the Tweddle oil instead of the Downer oil?

Ans. No, sir. We requested it.

Cross-int. 65. Might it not still have been an inducement, or an object, even if you did request it?

Ans. It certainly would.

Cross-int. 66. Since you have been selling the Tweddle oil, have you found that it was of uniform character?

Ans. No, sir. We have found it to vary in color only.

Cross-int. 67. Has it been of so uniform character as the Merrill oil, so far as you have known the latter?

Ans. The Merrill oil, in my opinion, has changed in the color, but as to uniformity I think it has been more uniform than the Tweddle, although there was a long time that we did not purchase or sell it.

Cross-int. 68. Taking lots that you received from the Tweddle manu-

facturer within a short period of each other, have you not found that they varied in their character to such extent as to give rise to complaints on the part of your customers, or to cause you trouble in other ways to some extent?

166 Ans. No, sir. They never gave rise to any complaints on the part of our customers, and if we found they varied in color, we rejected the lot or accepted it, as we thought best. The purpose for which we used the oils were known to the consumer in only a few cases.

Cross-int. 69. In what number of cases have you rejected lots because they did not come up to the standard you required?

Ans. We never totally rejected a lot; we only rejected them to the extent of getting a discount on the price originally to be charged on account of the color, and this is not over three cases.

Cross-int. 70. You have purchased and sold a large quantity of Tweddle's oil, have you not?

Ans. Several hundred barrels.

Cross-int. 71. Can you state more nearly how many barrels?

Ans. I should say five or six hundred.

Cross-int. 72. You spoke of the arrangement which you made originally being still in force to a certain extent. In what way has it been varied?

Ans. We have verbally allowed Mr. Bartlett, the general agent for Tweddle, to sell to any New England parties who wished to buy the oil and would not buy through us on account of our being competitors for the consuming trade.

Cross-int. 73. Do you receive any commission or allowance, directly or indirectly, from these sales made by Mr. Bartlett?

Ans. No, sir.

And in answer to direct interrogatories resumed, deponent saith:

Int. 74. You say you remember a conversation with Mr. Joshua Merrill, in which you told him "that he was on the right road, meaning to refer to former conversations, telling him that the odor was satisfactory, but that the color was not so for the purpose for which we wanted to use it," viz, for mixing with fatty oils; and you say the peculiarity of the color you refer to was a blue shade. Do you mean that the mixing with fatty oils for which you wanted it was a mixing to adulterate in the manner and for the purpose you referred to in your direct examination?

Ans. I referred to that.

Int. 75. When you received Mr. Wm. Merrill's denial (if he was the party) of the mixing of Trinidad or resin oil in the Merrill oil,

167 did it change your conviction that such mixture existed, and if not, why not.

Ans. It did not wholly change my conviction; I believed my own senses first.

Int. 76. Is it true that the Merrill deodorized oil is mainly or largely sold by oil-dealers in this market mixed with fatty oils, the mixture being sold as and at the price of unadulterated fatty oils?

Ans. It is largely so.

Cross-int. 77. Is the same true of the Eclipse topaz oil?

Ans. It is.

Cross-examination resumed:

Cross-int. 78. What knowledge have you of the manner in which the Merrill deodorized oil is sold by other dealers than yourself?

Ans. From their own statements to me.

Cross-int. 79. Do you mean to be understood that the dealers gen-

erally in Boston, including yourself, sell the mixed oils representing them to be pure fatty oils?

Ans. They sell them so where they can without direct misrepresentation.

Cross-int. 80. Do you not know that many customers buy fatty oils and Merrill's or Tweddle's deodorized oil or other hydrocarbon oils for the purpose of mixing them themselves for their own use?

Ans. I know that they intend to, but they are fortunate if they get the fatty oils without being slightly adulterated.

Cross-int. 81. Do they not buy in this way under the belief that the oils can be advantageously mixed?

Ans. Yes, sir; I suppose they do.

Cross-int. 82. When you speak of Trinidad and resin oil, do you mean the oil sold by Mr. Merrill as Trinidad oil, or that oil and some other oil different from it in some respects?

Ans. That oil and some other oils.

D. M. YEOMANS.

Adjourned to 28th inst., at 10 a. m.

168 *Deposition of Charles F. Coffin, taken, subscribed, and sworn to before N. Austin Parks, esq., special examiner,—Jan.* 28, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Charles F. Coffin; age, thirty-five years; residence, South Boston. I am a manufacturer of paraffine oil.

Int. 2. How long have you been in that business?

Ans. Six or seven years.

Int. 3. From what base have you made paraffine oil, and for what purposes have you produced it?

Ans. I have made it from petroleum tar or residuum, for lubricating purposes.

Int. 4. Where have you carried on that manufacture during those years?

Ans. At Old Harbor wharf, South Boston.

Int. 5. Describe briefly the process by which you have produced your paraffine oil from the tar.

Ans. We put the tar into the stills and heat it up and distil it off, leaving in the stills coke.

Int. 6. When the vapors of this distillation were condensed, what, if anything, did you do with the oil of condensation to prepare it for the market?

Ans. We refined it with chemicals, acids and alkalies.

Int. 7. Did you sometimes subject the oil to a second distillation before or after refining by chemicals?

Ans. I did.

Int. 8. For what purpose?

Ans. For further purifying or refining; to make an extra oil.

Int. 9. Has all the paraffine oil which you have put in market been produced by the process you have described, whether with single or double distillation?

Ans. It has.

169 Int. 10. What proportion of your paraffine oil had been subjected to the second distillation?

Ans. A small portion of it; not over ten per cent., I should say.

Int. 11. In what part of the six years that you have been at work has the bulk of this double-distilled oil been made?

Ans. Within the last three to four years; three and one-half years, perhaps.

Int. 12. I understand that this second distillation was similar to the first—conducted in the same manner?

Ans. It was.

Int. 13. Have you with you a specimen of your paraffine oil made by the process you have described, with one distillation and one with double distillation? If so, will you produce them?

Ans. I have. I produce them, marked, the single distilled, "Exhibit respdts., No. 27," and the double-distilled, "Exhibit respdts., No. 28, N. A. P., exr."

Int. 14. About how many barrels of your paraffine oil of both grades have you produced annually upon an average for the past six years?

Ans. We turn out on an average about a hundred barrels per week.

Int. 15. Through what parties in this market has your paraffine oil been mostly sold?

Ans. Mr. Joseph Harris, jr., has been my only selling-agent. Yeomans & Goss, Crane, Wait & Co., and others, have sold my oil to the consumers, obtaining it from Mr. Harris.

Int. 16. Did the refining treatment by chemicals that you have referred to differ from that practised by other paraffine-oil manufacturers during the same time, except as to the care and skill with which it was conducted?

Ans. That I couldn't tell you. I presume it to be nearly the same, but I don't know how others manufacture it.

Int. 17. Describe briefly what your chemical treatment for refining the oil is.

Ans. We refine it with sulphuric acid—settle it out; and the acid combines with the impurities of the oil, and being heavier than the oil, they sink to the bottom. Then we wash it with water, and treat it with a solution of soda. That settles to the bottom and is drawn off, and it is afterward again washed in water.

170 Cross-examination by Chauncey Smith, esq., counsel for complainants:

Cross-int. 18. Where do you obtain the petroleum residuum which you distil?

Ans. In Philadelphia, Baltimore, and some here. We buy it from the burning-oil refiners. I have bought some from the Downer Kerosene Oil Co.—not a great deal.

Cross-int. 19. It is a residuary product obtained in distilling petroleum in the manufacture of burning-oils, is it not?

Ans. It is.

Cross-int. 20. What other products do you obtain besides lubricating oil?

Ans. We obtain what we call a light oil, and what the burning-oil folks call a medium oil, from 33 to 37 gravity, and we obtain paraffine wax.

Cross-int. 21. What is the oil you have last spoken of used for?

Ans. We sell it to the dealers. I don't know what they do with it.

Cross-int. 22. Under what name do you sell this oil?

Ans. All the name I ever sold it by is light oil.

Cross-int. 23. At what degree Beaumé do you divide these light oils from the lubricating oils in your process of distillation?

Ans. At 33; all above 33 is the light oil, all below the heavy.

Cross-int. 24. What is the gravity of your two lubricating oils as you put them on the market?

Ans. About 29 or 29½; lots vary from 28½ to 29½.

Cross-int. 25. Is there any difference in the gravity of the two oils manufactured by you, the single-distilled and the double-distilled?

Ans. About one degree; the double-distilled is about one degree the lightest.

Cross-int. 26. What proportion of the product of distillation do you obtain in what you call the light oils, and what in the heavy oils?

Ans. That is something hard to tell. It depends upon whether the residuum is heavy or light residuum. The proportion varies from a fifth to a tenth of light oil; sometimes one-half. There have been cases of that kind. Different refineries make different qualities of tar.

Cross-int. 27. When you redistil your lubricating oil, do you
171 not obtain, besides the refined lubricating oil, some of the light oil also of which you have spoken?

Ans. We do.

Cross-int. 28. Are not the light oils which you produce, used largely or wholly for burning-oils?

Ans. I can't say. I never sold them for that. I have asked the dealers what they did with them, and they didn't see fit to tell me.

Cross-int. 29. Have you not sold your lubricating oil to Smith & Merrill of this city to some extent?

Ans. Yes.

Cross-int. 30. At what prices have you been selling your lubricating oils of such grade within the last three months?

Ans. The medium, or once refined, from thirty-four to thirty-five cents. The double-refined at forty.

Direct resumed:

Cross-int. 31. To whom do you sell your lubricating oils at the prices you mentioned?

Ans. To dealers here in Boston.

CHARLES F. COFFIN.

Deposition of David M. Yeomans, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, special examiner, Jan. 28, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. Has your firm ever dealt in paraffine lubricating oil manufactured by Charles F. Coffin, at South Boston?

Ans. Yes, sir.

Int. 2. For how long and to what extent?

Ans. For, I should say, six years. We have sold many hundred barrels—whether 1,500, 2,000, or 3,000, I couldn't tell.

Int. 3. To what classes of consumers and for what uses have you sold it?

Ans. To all classes of consumers—more particularly to use for mixing with fatty oils for cotton and woollen mill use.

172 Int. 4. You have sold it, then, sometimes pure to be so mixed by the user, and sometimes you have mixed it yourselves before selling?

Ans. Both ways.

Int. 5. Have you ever sold it pure to be used pure for lubricating?

Ans. In very few instances.

Int. 6. In what proportions have you mixed it when you sold it mixed?

Ans. From twenty-five to seventy-five per cent. of the Coffin oil.

Int. 7. Has the Coffin lubricating oil had a slight pungent petroleum smell?

Ans. Always, more or less.

Int. 8. In this respect—i. e., as to the strength of this smell—how has it compared with other paraffine lubricating oils in the market, excluding Merrill's and Tweddle's deodorized oils?

Ans. I should say it ranked next to these last-mentioned oils in this particular.

Int. 9. How does the Coffin oil rank, in your judgment, as to all the qualities, taken together, required for a lubricating oil, as compared with any other paraffine lubricating oil in the market?

Ans. His best grade ranks first, in my estimation.

Int. 10. If the Merrill deodorized oil, so called, possesses any advantage for any purpose in your judgment over the Coffin oil, what is that advantage?

Ans. On account of its not having any petroleum odor, and on account of its color also, the Merrill oil possessing less of the green or blue petroleum shade.

Int. 11. What is the advantage, if any, of its having none of the petroleum odor, and so little of the blue and green shade?

Ans. For adulterating fatty oils.

Int. 12. Have you sold the Coffin oil for lubricating purposes to manufacturing corporations in Lowell, Lawrence, and elsewhere? If so, to about how many, and whether as a regular account with them or only occasionally?

Ans. We sold it very largely to those manufacturers of cotton and woollen goods, furnishing regular supplies for from one to three years at a time. The number of corporations or mills coming under this head might be called twenty or twenty-five; and an equal amount was
173 sold in an occasional way to other mills; that is, we only secured a part of their orders.

Int. 13. What has been the result, so far as you know, of the use of the Coffin oil for lubricating at these mills?

Ans. The result has been wholly satisfactory.

Int. 14. Under what name or names have you sold the Coffin oil to them?

Ans. Under the name of "Yeomans' extra sperm lubricating oil." That was our brand of that oil.

Int. 15. At what prices have you sold this oil to consumers?

Ans. During the past six years the price has varied from 75 cents to $1.75 per gallon.

Int. 16. That varied according to what?

Ans. During the war oils of all kinds were very high, and that is the time we sold at the highest prices.

Int. 17. Is your present price to consumers seventy-five cents or thereabouts?

Ans. From seventy-five to ninety cents, according to the quantity used.

Int. 18. You said in your former deposition that you remember telling Mr. Joshua Merrill that his deodorized oil was superior to anything of the paraffine-oil nature that you had ever seen before. In what respect did you then or do you now think it superior to or to possess any advantage over the Coffin oil?

Ans. In odor and color, as before mentioned. I supposed I qualified that the other day.

Int. 19. You said in that deposition that the paraffine oil manufactured by the Downer Kerosene Oil Co. previous to Merrill's alleged invention ranked among the first class. How did that oil compare with the Coffin oil as respects body, color, and odor; and what do you mean by the expression "among the first class" in that connection?

Ans. In color and odor the oil was fully equal to Coffin's, but not so heavy in body. By "among the first class" I meant that it was, as I have stated it, first-class color and first-class odor, and, I might add, always brought among the best prices.

Int. 20. You say that you sold the Coffin oil to the mills under
174 the name of "Yeomans' extra sperm lubricating oil." Under what name or names did you sell it when unmixed?

Ans. Sometimes "Yeomans' spindle-oil," "Yeomans' paraffine oil," and occasionally under Coffin's own brand.

Int. 21. You spoke in your former deposition of having produced at one time, at the Maverick Oil-Works, at East Boston, a small quantity of lubricating oil by distillation. What apparatus was used for that purpose?

Ans. The works were then known as the Philbrick & Parsons Refinery. The name of the apparatus used I don't remember. It was an English patent still.

Int. 22. Was the lubricating oil so produced free from the petroleum smell?

Ans. It was, almost entirely.

Int. 23. And how was that accomplished?

Ans. Simply by running the oil through this patent still.

Int. 24. Do you mean that the source of the smell in question was removed by distillation?

Ans. Yes, it was.

Int. 25. Did Mr. Joshua Merrill ever visit these works with you, or examine the apparatus in question with you? If so, in what year was it, as near as you can remember?

Ans. He did; I think it was in 1865.

Int. 26. Did he receive any explanation from you upon that subject? If so, what?

Ans. So much as I was able to give him. The questions that were asked were answered.

Int. 27. Did he see the still in operation making the lubricating oil you have described, or did he have its operation described to him?

Ans. I think the still was not in operation.

Int. 28. About how many barrels of this lubricating oil were produced and sold?

Ans. A very small quantity; from seventy-five to one hundred barrels only, as near as I remember; the price of native oils interfering with our producing it in that way, and also from the fact that the oil would chill at a comparatively high temperature.

175 Cross-examination by Chauncey Smith, esq., counsel for complainants:

Cross-int. 29. What did that English patent apparatus cost?

Ans. The cost has been stated to me to have been as high as $60,000. The only cost shown on the books of Philbrick & Parsons, after their failure, was about $45,000.

Cross-int. 30. What became of the apparatus after you had distilled seventy-five or one hundred barrels with it?

Ans. Several attempts were made to make it more profitable, and were finally abandoned through want of means on the part of Parsons, and it still stands at the Maverick Oil-Works.

Cross-int. 31. When you speak of the petroleum smell of oils, you refer, I suppose, not to the smell of crude petroleum, but to the smell common to all oils manufactured from petroleum, before Merrill produced his deodorized oil.

Ans. No, sir; I mean the smell of crude petroleum. Several productions from crude petroleum have been put upon the market scented with citronella, sassafras, etc.

Cross-int. 32. Do you not know that the oils distilled from crude petroleum, before Merrill produced his deodorized oils, had a peculiar odor, as produced from the still, different from the odor of crude petroleum as it comes from the well?

Ans. I do know that the oils as they came from the still had a different odor from crude petroleum; yet I should say that the odor of crude petroleum was the most prominent, or that it never lost its crude-petroleum smell.

Cross-int. 33. Did you not, in making the oils which you sold under the name of "Yeomans' extra sperm lubricating oil," use the oils of other manufacturers besides Mr. Coffin's?

Ans. We did.

Cross-int. 34. What has been the price of Mr. Coffin's oils, of the best quality, as compared with the price of Tweddle's and Merrill's deodorized oils at the same time?

Ans. About ten cents a gallon less.

Direct resumed:

Int. 35. Can you tell us how the mill agents or superintendents
176 who have used the Coffin oil mixed with fatty oils, which you have sold them, will be able to identify it for the purpose of testimony hereafter, as being the mixture of Coffin oil with the fatty oil, and not a mixture of some other paraffine oil with the fatty oils?

Ans. They'd have to rely on our statements. We can show direct sales made of mixtures to these mills during the time that we purchased Coffin's oil only. Principally during '66 and '67 we relied upon his oil for that purpose.

D. M. YEOMANS.

Adjourned to 30th January, at 10 a. m.

Adjourned to January 31st, at 10 a. m.

Deposition of Wm. F. Salmon, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, Feb. 1, 1871.

Direct examination by Jabez S. Holmes, esq., of counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Wm. F. Salmon; age, 39 years; residence, Lowell, Mass. I am manager of the Lowell Hosiery Co.

Int. 2. How long have you had charge of that company?

Ans. Since its organization. It was chartered, I think, in March, '69, but we didn't do anything until about a year ago last December.

Int. 3. What was your occupation before March, '69?

Ans. From the 10th of November, '65, to the 31st December, '68, I was agent of the Lawrence Manufacturing Co. at Lowell.

Int. 4. How many spindles and how many operatives were there in the Lawrence Manufacturing Co. Mills?

Ans. About 60,000 spindles. While running full we employed about 1,400 hands.

Int. 5. While you were in charge of the Lawrence Manuf. Co.'s Mills what kind of oil did you use in the mills for lubricating purposes?

Ans. When I took charge of the company they were using a mixture of sperm and Downer's kerosene, so called at the mill. During the first six or eight months of my agency I tried several kinds of oil mixed in different proportions, and some pure. In the summer of '66 I
177 settled upon Yeomans' extra sperm lubricator—I think that was the title—and continued its use during the rest of my agency.

Int. 6. What oil are you now using at the Lowell Hosiery Co.?

Ans. Yeomans' extra sperm lubricator.

Int. 7. Did you, while at the Lawrence Mills, try any experiments or institute any test to find out the comparative merits of the oil which you have called the Yeomans' oil and the other oils, including Downer's lubricating oil, which you say you tried there, and, if so, what were the experiments or tests, and what were the results?

Ans. I endeavored to give all the oils a fair trial by putting quantities of the different oils into actual use and receiving the reports of the overseers using the same. They were required to give their opinion and experience as to the lubricating powers and the wear of the oil—that is, the length of time that the different oils would lubricate. The parties making the test had no knowledge of what the characters of the oils were. I also, in 1868, made a comparative test of the Yeomans' oil, the Downer oil, and sperm oil, upon the McNaught oil-test, so called, with a view to ascertaining the relative friction of each. At that test Yeomans' stood 13, Downer's 9, and sperm 14. I also made a test upon a spinning-frame, comparing the Yeomans' oil with what was known as Quincy's extra oil, and found the actual power by weight required to drive the same very nearly equal.

Int. 8. What was the result of the testing of the different oils by the overseers, they not knowing what oils they had been using?

Ans. There was a general report in favor of Yeomans' oil. I will give the experience of one particular test which I have in mind. An overseer of a mule-spinning room was much opposed to making any experiments, because he was satisfied with the oil that he had been using, which was a mixture of sperm and Downer's kerosene, so called. I had my clerk in the counting-room put up two cans of oil—one gallon each—and number them one and two. I did not myself know which oils the cans contained. I sent these two cans to the overseer referred to, directing him to use one can on one mule and one upon the next adjoining. He did so, and made his report after something over a month's trial, and upon going to the clerk with the cans we found that he reported in favor of the Yeomans oil. The other can contained
178 the sperm and Downer's kerosene, the same as he had been previously using.

Int. 9. When you speak of "Downer's kerosene" oil, do you mean an illuminating kerosene oil, or do you mean a paraffine lubricating oil?

Ans. I mean a lubricating oil.

Int. 10. Please explain what the figures expressing the result of your experiments with Yeomans' and other oils mean. I mean by the McNaught test.

Ans. They show the relative friction of the oil; zero representing no friction.

Int. 11. By the test spoken of it appears that Downer's lubricating oil stood at 9, Yeomans' at 13, and sperm at 14. What difference in the characters of the oils do these differences in the figures represent?

Ans. Downer's shows the least friction; Yeomans' next, and sperm next.

Int. 12. According to the McNaught test, will the lightest-bodied of the various oils tested stand highest or lowest, numerically?

Ans. Lowest.

Int. 13. For actual lubricating uses are the light or the heavy bodied oils more desirable?

Ans. That would be a matter of opinion. A light-bodied oil would run with but little friction, but would require more frequent oiling of the machinery. A heavy oil would, by its friction, require more power to drive the machinery. A mean between the light and heavy would, in my opinion, be the most desirable for machinery-oil.

Int. 14. Was the Downer lubricating oil, tested as above, a light-bodied or a heavy-bodied oil?

Ans. Light-bodied.

Int. 15. Was that quality of the oil an advantage or a disadvantage, and why?

Ans. In my opinion, a disadvantage, for the reason given in answer to the 13th interrogatory. And I might add that the price has something to do with the relative value of the oil for use.

Int. 16. If I understand you, then, the result obtained by these tests was that the sperm oil had more friction than the Yeomans, and
179 Yeomans' more than the Downer; but the Downer required more frequent application of the oil. Am I right?

Ans. You are, presuming the Downer to be used clear.

Int. 17. Have you, since the experiment above spoken of, made any other friction-tests of various paraffine lubricating oils? If so, with what oils, and with what results?

Ans. I made a test this week, with what C. B. Coburn & Co., of Lowell, call their best Downer's spindle oil; their best sperm; a mixture of two-thirds sperm and one-third of the Downer oil referred to; of lard oil; and the Yeomans extra sperm lubricator, now in use at the Lowell Hosiery Co. Two tests were made; the average is as follows: Sperm, 17; Downer's, 14; lard, 34½; the mixture, 15; Yeomans', 13.

Int. 18. What percentage does a difference of one, in the results obtained by these tests, indicate?

Ans. It depends upon what you base the percentage on, whether the highest or lowest figures given. Basing it upon the lowest, it would be about seven and one-half per cent.

Int. 19. Have you ever found any objection, for lubricating purposes, to the oil which you call the Yeomans oil? If so, please state it.

Ans. I never found any.

Int. 20. Have you ever had any complaints from operatives of a bad odor from the oil, or of a deleterious effect upon their health?

Ans. Never.

Int. 21. Have you ever been troubled or annoyed by a deposit upon the machinery, or the windows of the mill, from the use of this oil?

Ans. No, sir; never.

Int. 22. Has the Yeomans oil during the time that you have used it preserved a uniform standard?

Ans. So far as I know, it has.

Int. 23. Did you at the Lawrence mill use it upon the spindles as well as upon other parts of the machinery?

Ans. I did.

Int. 24. What kind of goods were made at that mill while you were agent?

Ans. Sheetings, shirtings, drillings, and hosiery.

Int. 25. Did you ever have any trouble from staining the goods you have named, caused by the use of this oil?

180 Ans. I never did.

Int. 26. Was there, at that time, to your knowledge, trouble at other mills in Lowell from stains caused by the use of other lubricating paraffine oils?

Ans. I cannot, of my own knowledge, say that there was at any mill in Lowell.

Int. 27. If there was any such trouble, please state what it was, and how you know about it.

Ans. I cannot say that I know of any trouble at mills in Lowell.

Int. 28. Was there at that time (while you were at the Lawrence mills) any such trouble at any mill that you know of?

Ans. There was trouble, and I have seen at the Lowell bleachery and in Boston pieces of bleached cloth having bright yellow spots which were attributed to the use of paraffine or kerosene oils. I cannot say where the goods were made.

Int. 29. How much of this Yeomans oil did you use at the Lawrence Company's mill?

Ans. Between 11,000 and 12,000 gallons.

Int. 30. How much do you use at the Lowell Hosiery Co.?

Ans. Between 400 and 500 gallons per year.

Int. 31. What price have you paid for this oil, on an average, since you began to use it?

Ans. I think it will average about ninety-five cents per gallon.

Int. 32. Is sperm oil, as a lubricator, open to any serious objection; and if so, what?

Ans. The objection to what has been called sperm oil in the market for the past ten years is its liability to gum, or become sticky, upon the bearings.

Int. 33. Does such objection apply to the Yeomans oil which you have spoken of?

Ans. It does not.

Int. 34. In your opinion, are slight differences in the color or the odor of paraffine lubricating oils of any practical importance?

Ans. In my opinion the odor of the paraffine oils that I have known for the past five years is not objectionable. I never had any complaint of the odor of any oil that I have tested since 1865. The color of the oils that I am familiar with, now in the market, would not be an

181 objection to their use. Some years since the oils run darker than now, and there was occasion for complaint about color.

Int. 35. You have spoken of an oil called "Quincy's extra." What rank did this oil hold as a lubricator when you made the experiments to which you have testified?

Ans. I consider its lubricating powers about the same as sperm.

Int. 36. When you purchased of Coburn & Co. the Downer oil with which you made your last experiment, what oil did you ask for?

Ans. I asked for Downer's spindle-oil of the latest manufacture. Mr. Coburn said that the barrel from which he gave me the sample came in within a week.

Cross-examination by Chauncey Smith, esq., of counsel for complainant:

Cross-int. 37. When you took charge of the Lawrence Manufacturing Company, you say they were using a mixture of sperm and Downer's oil. Did they buy the oils already mixed, or did they buy the oils separately and mix them themselves?

Ans. They were generally bought separately and mixed on the premises. I think in one or two instances they were mixed by Mr. Coburn or Coburn & Co.

Cross-int. 38. Did Coburn & Co. sell you the oils, both the sperm and the Downer, or either of them?

Ans. They sold both.

Cross-int. 39. In what proportion did you mix the oils, at that time—in 1865? I mean the Downer oil and sperm oil.

Ans. I think the general mixture was $\frac{1}{3}$ Downer and $\frac{2}{3}$ sperm, though it was sometimes used half and half.

Cross-int. 40. What was the object of using mixed oil instead of either of the oils pure?

Ans. To reduce the cost per gallon.

Cross-int. 41. When you bought a mixed oil of Coburn & Co., you bought it as a mixed oil and not as pure sperm, did you not?

Ans. When I bought mixed oil I bought mixed oil, and when I bought sperm I bought sperm. My impression is that Coburn & Co.'s bills for mixed oil were made out as for so much sperm and so much of Downer's.

182 Cross-int. 42. How long did you continue to use a mixture of Downer's oil and sperm after you took charge of the Lawrence Manufacturing Company?

Ans. I think about four or five months. I think I continued its use in part some seven months.

Cross-int. 43. Who had immediate charge of keeping, mixing, and distributing the oil in that establishment while you were there?

Ans. It was under the immediate charge of the overseer of the yard, and generally mixed and distributed by a watchman under his direction.

Cross-int. 44. Will you give the names of those persons?

Ans. The only name I can at present call to my mind is Mr. William M. Corey, the overseer.

Cross-int. 45. In your answer to the 7th interrogatory, you speak of receiving reports from the overseers in that establishment who were using the oils upon which you experimented. Will you give the names of these overseers as far as you are able?

Ans. Mr. John Merrill, S. P. Jordan, A. G. Flint, Isaac Cooper, Stephen Bartlett, Noah Conant, Daniel Wheeler, E. C. Kingsley, James Foster, William Watson, Jarel Gould, Horace Parmenter. That's all I can call to mind now. There were more of them.

Cross-int. 46. In your answer to 8th interrogatory, you refer to one particular overseer to whom you gave two cans of oil prepared and numbered as No. 1 and No. 2. What was the name of that overseer?

Ans. John Merrill.

Cross-int. 47. In interrogatory 7th, you were inquired of as to Yeomans' oil, and several times in your answers you have spoken of Yeomans' oil. In using that term did you refer to the same oil which, in your answer to interrogatory 5th, you spoke of as Yeomans' extra sperm lubricator?

Ans. I did.

Cross-int. 48. That was a mixed oil, was it not.

Ans. I don't know, sir.

Cross-int. 49. Did you buy it under the belief that it was pure sperm oil?

Ans. I did not.

Cross-int. 50. Then you believed it a mixed oil when you bought it, did you not?

183 Ans. I believed it was.

Cross-int. 51. And what oils did you believe were contained in it?

Ans. I believed it contained 85 to 90 per cent. of filtered petroleum and from ten to fifteen of tallow, or some other fatty oil.

Cross-int. 52. What made you believe that?

Ans. Because Mr. Yeomans told me so, and I believed him.

Cross-int. 53. Are you using that oil now?

Ans. Yes, sir.

Cross-int. 54. How early did you commence using that oil?

Ans. I think my first purchase was in April, '66.

Cross-int. 55. Do you believe that the oil you are purchasing now under that name is made of the same ingredients mixed in the same proportions?

Ans. I do, for the reason that it appears to work the same upon the machinery.

Cross-int. 56. What prices have you paid for it within the last three months?

Ans. Ninety cents per gallon.

Cross-int. 57. In your answer to interrogatory 8th you refer to some experiments made in 1868 upon different oils with the McNaught oil-test. At what time of the year were those experiments made?

Ans. I think in the spring.

Cross-int. 58. In addition to Yeomans' oil you mention Downer's oil and sperm oil as being the subject of those experiments—was that oil you speak of as the Downer oil his pure lubricating oil or a mixture of that oil with something else?

Ans. My impression is that the sample tested at that time was obtained from Coburn and Co. and known to the trade as Downer's spindle-oil. I do not know whether it is pure paraffine or not.

Cross-int. 59. Did you make any comparison with the McNaught instrument between Downer's oil and a mixture of Downer's oil and sperm, such as you had previously used?

Ans. I did not at the time of the test in 1868.

Cross-int. 60. In your answer to interrogatory seventeenth, you speak of other experiments with the McNaught instrument made this week upon the Downer spindle-oil—Coburn's best sperm—a mixture of $\frac{2}{3}$ sperm and $\frac{1}{3}$ of the Downer's oil referred to, of lard oil—and Yeo-

184 mans' extra sperm lubricator. Do you understand that the Downer oil you used was the same kind of oil as that you used with your experiments in 1868?

Ans. I do not.

Cross-int. 61. Did you understand it was an oil the Downer Company are manufacturing and selling as a deodorized oil?

Ans. I did not.

Cross-int. 62. In what respect did you understand it to differ from the Downer oil you used in the experiments of 1868?

Ans. I understood the name to be the same; the oil is much lighter in color and of heavier body. That is my observation of it.

Cross-int. 63. In making the experiments in 1868, at what speed did you run the McNaught instrument?

Ans. I don't know. It makes no difference about the speed so long as the same speed is applied to all the tests.

Cross-int. 64. Do you know whether you run it at the same speed in the experiments made this week?

Ans. I think the speed is the same. The machine is in the same location, and I think runs with the same pulleys.

Cross-int. 65. You do not know, however, that it was run at the same speed in the two experiments?

Ans. I do not know; I think there has been no variation for fifteen years.

Cross-int. 66. Were these last experiments made at the Lawrence mill?

Ans. Not any of them.

Cross-int. 67. Where were they made?

Ans. At the mill of the Lowell Manufacturing Company, at Lowell.

Cross-int. 68. Did any one take part in those experiments besides yourself?

Ans. Yes; Mr. George W. Worthen, engineer of the Lowell Manufacturing Company.

Cross-int. 69. Do you know whether the temperature of the instrument and the oil was the same in the experiments this week and those in 1868?

Ans. I know that the temperature was not the same; there was a difference of four degrees by the thermometer.

185 Cross-int. 70. What was the object of making those experiments this week?

Ans. For information on my own part, having been notified that my deposition would be wanted in this case.

Cross-int. 71. In your answer to interrogatory 8th you gave an account of an experiment in which you furnished an overseer with two kinds of oil, one made with sperm and Downer's oil. Do you know in what proportion they were mixed in that experiment?

Ans. It was the mixture that Mr. Merrill had been using for some time. I think $\frac{2}{3}$ sperm and $\frac{1}{3}$ Downer's; but I cannot be positive, as there were different mixtures used at the time, some half and half, and some as above.

Cross-int. 72. You have spoken of an oil known as Quincy's extra oil. Is that a mixed oil?

Ans. I understand it to be so.

Cross-int. 73. What do you understand it to be composed of?

Ans. Of a refined tallow-oil and kerosene or paraffine.

Cross-int. 74. In what proportions do you understand the ingredients to be used?

Ans. That was Mr. Quincy's secret. I never learned it.

Cross-int. 75. Who prepares and sells this oil?

Ans. John W. Quincy, I think his name is, of New York. I bought it through an agent named Oran, I think.

Cross-int. 76. Have you any knowledge as to who had manufactured the paraffine oils which Mr. Yeomans has mixed with another oil in preparing the oil that he has sold to you?

Ans. I supposed that Messrs. Yeomans & Goss manufactured their own paraffine oils. I have been to what purported to be their manufactory and witnessed the manufacture of the oil that I used.

Cross-int. 77. Where was that manufactory?

Ans. In East Boston, I think. It was over that way.

Cross-int. 78. You refer, of course, to the distillation of the oil?

Ans. I do not.

Cross-int. 79. What do you refer to?

Ans. To the filtering.

Cross-int. 80. Do you understand that the oil that Mr. Yeo-
186 mans has furnished you as his extra sperm lubricating oil was made by mixing a fatty oil with a lubricating oil produced by filtering petroleum, as distinguished from oil produced from the distillation of petroleum?

Ans. I do.

Cross-int. 81. Do you understand that the oil that he has furnished you is prepared in the same way and from the same ingredients as that which he has sold to other parties under the name of Yeomans' extra sperm lubricating oil?

(Objected to as incompetent.)

Ans. I don't claim to have any knowledge of what he has sold to other parties.

Cross-int. 82. Do you understand that he prepares the oil he sells to you especially for your use?

Ans. I do not.

Cross-int. 83. Do you know of any other parties who use an oil prepared from the same ingredients mixed in the same proportions as that which Mr. Yeomans furnishes you?

(Objected to for form and substance.)

Ans. I have no knowledge of Mr. Yeomans' business except my own dealing with him.

Cross-int. 84. My question is not what you know about Mr. Yeomans' business, but whether you know of any other parties who use an oil made up in the same way as the oil which you use?

(Objection continued.)

Ans. The question involves a knowledge of Mr. Yeomans' business in preparing the oil, of which I have no knowledge.

Cross-int. 85. You have stated what you believe to be the ingredients of the oil which you are using and the proportions in which they are mixed. Do you know of any other parties using an oil made of those ingredients mixed in those proportions?

(Objected to as before.)

Ans. I do not. I have not the means of obtaining such knowledge.

Direct resumed:

Int. 86. What oil, if you know, was used at the Lawrence Manufacturing Co. Mills for lubricating just before you went there?

Ans. The mills were stopped during the war and were just starting up when I went there. They were then using the mixture I have
187 spoken of. I learn from the books that they were using sperm oil before they stopped.

Int. 87. Are you able to say how the quantity of sperm oil used there compared with the quantity of the Yeomans oil which you used year by year?

Ans. I had occasion to write the comparison of the year 1861, with 1868, at which times the mills were running very nearly full; in 1861, they were using all sperm; in 1868, all Yeomans; and in a consumption of over 5,000 gallons each year the difference was 100 gallons of Yeomans more than sperm.

W. F. SALMON.

Adjourned to 2d inst., at 10 a. m.

Deposition of Isaac Deming, taken, subscribed, and sworn to before N. Austin Parks, examiner, Feb. 2, 1870.

Direct examination by Jabez S. Holmes, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Isaac Deming. I am 65 years of age; residence Lowell, Mass. I am a manufacturer; a spinner.

Int. 2. In what mill are you employed and what is your position there?

Ans. In the Tremont Mill. I am overseer of spinning.

Int. 3. How many spindles are there in that mill, and how many operatives are employed there?

Ans. 33,334 spindles at present; not far from 500 operatives.

Int. 4. How long have you been so employed?

Ans. I have been there 32 years next June.

Int. 5. Have you during that time used in the mill and in your department a lubricating oil sold by Yeomans and Goss or D. M. Yeomans & Co. of Boston; if so, when did you begin to use it and for what purposes was it used?

Ans. I should think somewhere in 1866 or '67, we used it in my department for oiling, in the general use of the room.

Int. 6. For how long time was it used?

188 Ans. I should think it was used off and on say three years. I can't say we used it permanently all that time. They changed oil frequently.

Int. 7. While it was so used in the mill, what satisfaction did it give as a lubricating oil?

Ans. It gave me better satisfaction in my department than any other oil that I used.

Int. 8. Did you ever have any trouble with it because of its odor, or because it deposited a coating upon the windows or machinery?

Ans. I never had any trouble from a deposit upon the windows, but I had one barrel once that gummed the machinery. I notified Mr. Yeomans immediately, and sent him a flier to show him the effects of it. There was no odor, that I ever observed, from it.

Int. 9. Did you, during the three years in which this oil was used at the mill, use it upon spindles, as well as upon other parts of the machinery?

Ans. We did.

Int. 10. Do you know whether during that time the oil was used in other parts of the mill besides your department?

Ans. I shouldn't want to swear that it was; but in my opinion it was used all over the mill.

Objected to.

Int. 11. By what name did you know this oil?

Ans. Yeomans' Extra No. 1, I believe it was called.

Int. 12. Did you, while the oil was used in your department, at any time use these other paraffine lubricating oils; and if so, how did they compare with the Yeomans oil?

Ans. We used various kinds. I found nothing that I ever used in the shape of paraffine oil as good as that.

Int. 13. Please state more particularly the circumstances of the trials in your department of other paraffine lubricating oils during the time that the Yeomans oil was in use there.

Ans. Well, during the time they shifted frequently. They would send us in oils that the men would complain of that they didn't work,

didn't run well. My men would come to me and want to know what was the matter with the oil; their spindles hung up, as they termed it. On making inquiries I would find that they had been changing the oil.

189 Int. 14. Upon what do you found your opinion of the merits of the Yeomans oil of which you have spoken; is it upon your own observation; and if not entirely so, upon what?

Ans. The merits of the oil I consider the body, being more wear to it, and requires less oil, or less number of times oiling. It has come under my own observation; my attention has been called to it by my men more particularly.

Int. 15. While using the oil did it keep up to a uniform standard of quality?

Ans. I should say it did, with the exception I have made.

Int. 16. What oil are you now using for lubricating in your mill?

Ans. What is purported to be one-half sperm and one-half Downer's.

Int. 17. From whom do you get your information as to what oil you are now using?

Ans. From the man who has charge of the oils and who delivers them.

Int. 18. How does the oils you are now using compare as a lubricating oil with the Yeomans oil which you used to use?

Ans. I shouldn't think there was two-thirds the body to it—the wear.

Int. 19. How does the quantity of oil now used there compare with the quantity of the Yeomans oil which you used to use?

Ans. I couldn't say; there have been so many changes in the machinery and a change in the manner of delivering the oil that I couldn't say—and I have no record—and we have run sometimes more and sometimes less machinery for the last four or five years.

Int. 20. Can you form an opinion as to the respective quantities of these oils used in your own department?

Ans. I should think we used a third more of the Downer and sperm than of the Yeomans.

Int. 21. What was the average price of the Yeomans oil?

Ans. I think a dollar. I believe we did pay a dollar and five for some; but I guess the average price was about a dollar.

Int. 22. Why did you cease using the Yeomans oil?

Ans. Because they found something else for me to use. That is all I know; the agent did that business, and I supposed they got other oils cheaper.

190 Cross-examination:

Cross-int. 23. You have stated that you are the overseer of spinning in the mills where you are employed. What, if anything, have you to do with the purchase of any supplies for that mill?

Ans. Nothing at all, any more than my advice, that is all.

Cross-int. 24. By whom has the oil used in that mill been purchased during the past ten years?

Ans. By the agent, I believe.

Cross-int. 25. Who is the agent?

Ans. Charles F. Battles was the agent up to last April.

Cross-int. 26. Was it or not the duty of the agent to ascertain what oil was best fitted for use in that mill?

Ans. I presume it was.

Cross-int. 27. You speak of using oil sold by Yeomans and Goss or D. M. Yeomans & Co. somewhere in '66 or '67. How do you know when that oil was purchased?

Ans. I have seen the bills of it.

Cross-*ans.* 28. Please state from what that oil was made, if you know. (Objected to.)

Ans. I don't know; only what it purported to be.

Cross-int. 29. You subsequently state that this last-named oil was used off and on say three years; that they changed frequently. If the quality of that oil was superior, can you give any reason for those frequent changes?

(Objected to for form and substance.)

Ans. I presume the oil agent came round and recommended another oil and they would want to try it because it come cheaper. That is my opinion.

Cross-int. 30. In your answer to 12th direct interrogatory you have stated that while using Yeomans oil you used other paraffine lubricating oils of various kinds; what kind did you use?

Ans. Well, I couldn't tell you particularly what kind we did use; we used some New York oils and some Boston oils, but what they were I couldn't say. I knew nothing about it.

191 Cross-int. 31. What do you consider the characteristics of a good lubricating paraffine oil to be?

Ans. A body that would wear, and prevent the machinery from wearing, and make the work run well.

Cross-int. 32. In the use at your mills is it of any importance what the odor of such an oil would be?

Ans. I should think it was, decidedly.

Cross-int. 33. What reason have you for considering the odor of the oil of importance, in your experience as overseer of spinning?

Ans. I think that the odor has a great effect upon the operatives for one thing.

Cross-int. 34. Have you ever had complaints made to you or in your presence of the offensiveness of the odor of any oils in use there?

Ans. Frequently.

Cross-int. 35. Have you ever prepared or witnessed any experiments for the purpose of testing by means of a dynanometer the lubricating qualities of the various oils in use at your mills; and if so, when, under what circumstances, and with what results?

Ans. I never had any tried to compare the different oils.

Cross-int. 36. In what respect did the other paraffine oils you have spoken of differ, as to lubricating qualities, from the Yeomans oil, as you have termed it?

Ans. They wouldn't wear near as long. There would be more trouble in oiling and more wear of the machinery—oiled much oftener.

Cross-int. 37. Do you know such to be the fact from any accurate experiments, or do you answer from mere general impression upon the subject?

(Objected to, for form and substance.)

Ans. I should answer that question: From my general observation of the running of the machinery and running of the work.

Cross-int. 38. Do you know whether there is any difference at different seasons of the year when the same oil is in use?

Ans. Well, I should think not; the temperature we keep about so. Some oils will chill quicker than others.

Cross-int. 39. Do you mix the oil you are now using yourselves, or buy it already mixed?

192 Ans. It is represented to me as bought and mixed by the man that has charge of the oil. That I couldn't swear to, but it is so represented to me.

Direct examination resumed:

Int. 40. (De bene esse.) Did you use the Yeomans oil of which you have testified at any one particular season of the year only?

Objected to.

Ans. I should think we used it at all seasons of the year.

ISAAC DEMING.

Adjourned to Feb. 3, at 10 a. m.

193 *Deposition of Henry P. Perkins, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February* 7, 1871.

Direct examination by Jabez S. Holmes, esq., of counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Henry Phelps Perkins; age, 38 years; reside at Lowell; I am salesman of John S. & Eben Wright & Co., of Boston.

Int. 2. Where were you employed before you took your present position with the Messrs. Wright, and for how long?

Ans. At the Lowell Bleachery for twenty-one and a half years up to November 1st, 1870.

Int. 3. What was the nature of your duties at the Lowell Bleachery?

Ans. To exercise a general supervision over all the goods in process and their delivery on the market as well as other clerical duties, which were secondary. My position was cashier.

Int. 4. While so employed, was there any general trouble among the mills who sent goods to your bleachery caused by oil-stains; if so, to what extent, and what exceptions, if any, were there?

Ans. The trouble wasn't at the mills that I know of. We had trouble at the bleachery. I know of no mill product consigned to the bleachery that was exempt from the difficulty from oil-stains except the goods of the Lawrence Manufacturing Co. The Lowell Bleachery is the largest establishment of the kind in the country and has a very high reputaion, which reputation has been made not only by the excellence of its work, but by the care which it has always exercised in protecting the reputation of the manufacturer. We invariably made it a point to lay aside imperfect goods, of whatever nature the imperfections might be, notifying the owners of such action. If the manufacturer, after being advised of the fact, ordered the regular marks or brands placed on the goods, we obeyed instructions, but always omitted our own name, to protect our own reputation. Imperative orders were given to lay aside and report all goods damaged or stained, and we experienced great difficulty with goods stained by oil in the process of manufacture. In most of these cases no oil-stains from any of the mills were apparent in the brown goods, and this fact was reported to our owners.

194 Int. 5. State what the nature of these stains was, and what effect they had upon the market value of the goods.

Ans. The stains were usually in streaks of yellow and sometimes of black—sometimes in spatters. The effect on the market value was to reject them as first quality of goods. If put on as first quality of goods they not only affected the reputation of the manufacturer, but subjected the selling agents to claims from his customers for damages for imperfections.

Int. 6. Do you mean to be understood to say that the goods sent to your bleachery from the Lawrence Co. were in any remarkable degree free from the oil-stains of which you have spoken?

Ans. I do. It was a subject of general comment by the finishers in

the mill and of myself, and not knowing how to account for it, I inquired of the agent of the Lawrence mill if he could account for it—if he used any different oil from other people.

Int. 7. Who was at this time the agent of the Lawrence Co.?

Ans. Wm. F. Salmon.

Int. 8. By what kind of oils, if you know, were these stains caused?

Ans. I cannot say of my own knowledge.

Cross-examined:

Cross-int. 9. During how many years did the Lawrence Manufacturing Co. have goods bleached at the Lowell Bleachery?

Ans. More or less during my entire service.

Cross-int. 10. And did the freedom of the goods of that company from oil-stains extend through the whole of the period?

Ans. I can't say. We never had our attention called to oil-stained goods of their manufacture, to my recollection.

Cross-int. 11. Do you know what kind of oil was used in other mills when the goods were affected by oil-stains?

Ans. Not of my own knowledge.

Cross-int. 12. And do you know to what kind of oil those oil-stains were generally attributed by those who were troubled by them?

Ans. I always understood from parties to whom we complained, that mineral oils would cause stains, and supposed that they were caused by mineral oils.

195 Cross-int. 13. Did you never know or hear of those stains being caused by the fatty oils?

Ans. Never, unless said oils had been in contact with iron.

Cross-int. 14. When was the freedom of the goods of the Lawrence Co. from oil-stains first observed and commented upon at the Lowell Bleachery?

Ans. I can't say; between 1865 and 1868.

Cross-int. 15. Did that freedom from stains continue down to the time that you left?

Ans. I should say it did down to the time the Lawrence Company stopped bleaching goods to any extent; which was, as near as I can fix it, about the middle of 1869, or perhaps the first of 1869; since which time we have hardly any difficulty with anybody's goods.

Cross-int. 16. In such goods as the Lawrence Co. have had bleached, whether more or less, since the first or middle of '69, did that freedom from oil-stains continue?

Ans. I should say it had as much as any other goods.

HENRY P. PERKINS.

Deposition of Isaac Deming, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 8, 1871.

Int. 1. You testified in your previous deposition that you never had any trouble from a deposit on the windows in using the lubricating oil furnished to you by Yeomans & Goss, or D. M. Yeomans & Co. Did you have such trouble from other paraffine lubricating oils which you used before the Yeomans oils?

(Objected to for form and substance.)

Ans. I have had.

Int. 2. Will you explain this coating of the windows, how serious it was; what, if anything, it required you to do; and how, if at all, the coating was removed?

(Objected to.)

Ans. It cast a coating on the windows of a kind of blue cast, so
196 that sometimes it would be almost impossible to see through the glass distinctly; to cleanse the windows we had to wash them with soap and water. It came off with soap and water. I should judge this coating would require ten minutes more gas every day from lighting-up time. I mean that it would require the gas to be lighted five minutes earlier in the morning and five minutes earlier in the evening. I mean to put it within bounds.

ISAAC DEMING.

Cross-examination declined.

Deposition of Wm. M. Bailey, jr., taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 9, 1871.

Direct examination by Jabez S. Holmes, esq., counsel for respondents.

Int. 1. State your name, age, residence, and occupation.

Ans. Wm. M. Bailey, jr.; age, 29 years; residence, Providence R. I. I am an oil merchant.

Int. 2. What is the name of your firm, and how long have you been connected with it?

Ans. It is not a firm now. It was formerly Bailey & Eaton, from 1862 to 1867; since then I am alone.

Int 3. While you were connected with the firm of Bailey & Eaton did that firm deal in what was known as the Maysville oil? If so, for how long, and to what extent, and what connection did you have with the sale of that oil?

Ans. It did exclusively during the whole time of the existence of the firm. We began by buying from a New York agent, and afterwards we bought directly from the company, with an exclusive right to certain territory; and still later, acted as commission agents of the company.

Int. 4. When you began the sale of the Maysville oil, was it an oil having an established reputation, and finding a ready sale in the market?

Ans. It had, I think, no established reputation at first in our district of Rhode Island. It had been sold in Boston and New York but for a short time only.

197 Int. 5. After you took the sale of the oil did you make efforts to extend its sale; if so, how, and what was the result?

Ans. We did make such efforts by personal attention to the business, and by employing agents, and also by establishing new offices. The result was a constant increase of the business, until the company stopped manufacturing.

Int. 6. Please state, generally, the increase in the amount of sales of this oil during the time that you were dealing with it.

Ans. Beginning with nothing, we got up to $20,000 per month, average sales, which was principally oil.

Int. 7. For what purposes was this oil sold?

Ans. For use on machinery generally—for lubricating.

Int. 8. To what class of customers was the oil principally sold by you?

Ans. To cotton and woolen manufacturers, railroads, and machine-shops.

Int. 9. What was, at this time, the general reputation of this oil as compared with other paraffine lubricating oils in the market?

Ans. So far as we could judge, it was considered the best in quality.

Int. 10. Did you ever have any complaints made to you by the users of this oil, of its color, or odor, or body?

Ans. I think probably at times there have been complaints, but seldom; and I should think as to odor, only in the beginning—when it was a new oil—unknown.

Int. 11. After the oil had become known and established in the market did you have any serious complaints of defects in it as a lubricating oil?

Ans. No. The oil seemed to be almost universally liked, and the customers who bought it were generally permanent customers. The principal question in selling would be a question of price merely.

Int. 12. At what price or prices did you sell the oil, and how did such price or prices compare with the prices of other paraffine lubricating oils then in the market?

Ans. It began, I should think, at seventy-five cents, and from that advanced to a dollar; most of the oil being sold at the last-named
198 price. That is the pure oil, unmixed. So far as I know, our prices were higher than the prices of other oils of the same or similar character in the market.

Int. 13. Was the oil usually sold by you clear, or mixed with other oil; and, if mixed, with what?

Ans. The greater part was sold mixed with animal oil.

Int. 14. By whom was the oil manufactured, and where, and by what process, if you know?

Ans. By the Union Coal and Oil Company, at Maysville, Ky.; in general terms, (that is all that I can give,) by retorting the coal, then by distillation, and then by purification with acids and alkalies.

Int. 15. Did the sales of the oil continue to increase up to the time when the company ceased to manufacture it.

Ans. I said yes. By that I understand the increase in general. They might increase one month and fall off another. I speak of our own sales.

Int. 16. When did the company cease to manufacture the oil, and for what reason, if you know?

Ans. About four years ago, during the winter of 1866 and 1867, as nearly as I can fix it. I don't feel prepared to state the reason, as I couldn't state it with certainty.

Int. 17. Who were the principal agents for the sale of the oil manufactured by the company while the firm of Bailey & Eaton were connected with it?

Ans. They had several agencies or dealers when we began; but after a short time, perhaps two years, we had, exclusively, the eastern business.

Int. 18. While you were connected with the sale of this oil, did it preserve a uniform standard of quality, or did it improve from year to year?

Ans. It improved, but I can't say whether from year to year or not; covering the whole time, it improved.

Cross-examined:

Cross-int. 19. What proportion of the Maysville oil did you sell, pure or unmixed?

199 Ans. About twenty per cent. pure, the balance mixed, judging from the time of which I have record.

Cross-int. 20. When you sold it pure did you understand that the

purchasers bought it to use as a lubricator, pure, or to mix it with other oils?

Ans. I had no means of knowing, but presume they mixed it generally.

Cross-int. 21. What kinds of animal oils did you use to mix with it?

Ans. I prefer not to state, as I am continuing the same business.

Cross-int. 22. When you sold a mixed oil did you sell it as a mixed oil or as an animal oil unmixed?

Ans. As a mixed oil; never as an animal oil unmixed.

Cross-int. 23. When you sold it mixed, did you sell it as Maysville coal oil?

Ans. We sold it at Maysville coal oil, but our brand was Maysville paraffine oil.

Cross-int. 24. In what proportions did you mix it with animal oils?

Ans. The average proportion was about half of each.

Cross-int. 25. Did you ever mix it with pure sperm oil; and, if so, in what proportions?

Ans. I am unwilling to name any oils that I mixed with, except generally as animal oils.

Cross-int. 26. When you say your sales reached $20,000 per month, does that mean your sales of mixed oils and the pure Maysville oil?

Ans. It covers both these oils and any other sales.

Cross-int. 27. Will you name the prices for each year of the pure Maysville oil?

Ans. I cannot separate the years.

Cross-int. 28. Can you give us the price during the year 1866?

Ans. The price was one dollar per gallon.

Cross-int. 29. Will you give us the names of your prominent customers during that year?

Ans. I decline to name my customers.

Cross-int. 30. I mean the names of customers to whom you sold the Maysville oil, either pure or mixed.

Ans. I prefer not to name my customers, unless there is some special purpose in it. From recollection I would name the Pacific Mills
200 at Lawrence, Mass.; the Naumkeag Steam Cotton Co. of Salem; Samuel Slater & Sons, of East Webster; the Smithville Manufacturing Co., Willimantic, Conn.; the Scituate Manufacturing Co., at North Scituate, Rhode Island.

Cross-int. 31. Will you give the names of agents whom you employed to sell the oil for you and introduce it into the market?

Ans. I only recollect two now; a man named T. R. Smith, I think; and one named Albro. I don't remember his first name.

Cross-int. 32. Where are these men now?

Ans. I don't know.

Cross-int. 33. Did you sell this oil to other dealers; if so, to whom?

Ans. We did. I can name some. Henry Barton & Co., of Lawrence; A. B. Coburn & Co., Lowell; Beach & Co., Hartford; and others.

Cross-int. 34. Can you state whether you furnished the Pacific Mills with all of this oil which they used?

Ans. I have no means of knowing.

Cross-int. 35. Did you sell to that company pure oil or mixed?

Ans. Generally mixed.

Cross-int. 36. In what proportion was the oil you sold to that company mixed with other oil?

Ans. About half paraffine.

Cross-int. 37. With what was the Maysville oil mixed which you sold to that company?

Ans. With whale-oil, I believe.

Cross-int. 38. How large a territory did you have the exclusive control of for this oil?

Ans. New England, New York, New Jersey, and part or all of Pennsylvania.

Cross-int. 39. At what price did you sell the mixed oil such as the Pacific Mills had, when the price of the pure oil was one dollar?

Ans. From recollection I should say from $1.20 to $1.80.

Direct examination resumed:

Int. 40. You say that you believed the Maysville oil which you sold to the Pacific Mills, mixed, was mixed with whale-oil; was it whale-oil that you mixed with the Maysville oil in your other sales of the Maysville oil mixed, prior to the time when the Maysville Co. stopped?

201 Ans. Almost always.

Int. 41. What was the advantage to you of mixing whale oil instead of sperm oil with the Maysville oil?

Ans. The less price of whale oil.

Int. 42. When used alone for lubricating, is the whale oil inferior to sperm oil; if so, in what respect?

Ans. I consider it inferior as oxidizing or gumming more rapidly.

Int. 43. When mixed with Maysville oil, as you have described, was there any difference in practice, that you know of, between the whale oil and sperm oil?

Ans. My impression was that there was little or none.

Int. 44. Did a man by the name of A. Mason ever travel as a selling-agent for the Union Coal & Oil Co.?

Ans. He acted as agent and selling-agent. I don't know whether he was considered travelling-agent or not. He sold for the company.

Int. 45. Was Marcus A. Finch an agent of the Union Coal and Oil Company?

Ans. He was.

Int. 46. Were Lewis and Durfee agents of that company?

Ans. They were agents, or selling the company's oil. I can't say whether they were authorized agents.

Int. 47. Were F. H. Lewis & Co. agents of or selling for the co.?

Ans. They had the sale of the company's oils. I don't remember whether as agents or not.

Int. 48. When you sold the Maysville oil to dealers did you sell it mixed or unmixed?

Ans. Both.

Cross resumed:

Cross-int. 49. You stated in a previous answer that your price for the mixed oil varied from $1.20 to $1.80 per gallon, when the price of pure oil was $1.00. Why did the price of the mixed oil vary so widely, while the price of one element of the mixture remained the same?

Ans. On account of the wide range in the price of the other element.

Cross-int. 50. How much did the price of whale oil vary while the price of the Maysville oil was constant at $1.00?

202 Ans. From recollection, I should say from $1.05 to $1.85. I can't state the time, but can only refer to the fact of the great advance which was caused by the distruction of the whaling-fleet by the Shenandoah.

Cross-int. 51. Have you any specimens of the Maysville oil, pure, in your possession?

Ans. I have, in Providence.

Cross-int. 52. Will you furnish samples to the plaintiff in this case?

Ans. I will.

Direct resumed:

Int. 53. Is the Maysville oil of which you have samples to furnish, some that has been left over from the time when the Maysville Co. stopped operations, or is it some which has been made from stock of that co. left over at the time it stopped?

Ans. The oil which I have was made and finished by the co.

W. M. BAILEY, JR.

Adjourned to the 11th inst., at 10 a. m.

Deposition of J. C. Bowker, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 11, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. J. C. Bowker; age, fifty-one; residence, Lawrence, Mass. I am paymaster at the Atlantic Cotton Mills at Lawrence.

Int. 2. How long have you been so employed in those mills?

Ans. I commenced in April, '56, and have continued ever since.

Int. 3. What are your duties?

Ans. I see to making up the pay-rolls; the invoicing of goods; the receiving and delivering of cotton, and do all the paying, keep the cash-accounts and the books of the company, so far as they are kept at the mills. I also attend to the buying of small supplies, either personally or through the agent. I go through the mills generally several times a day, but I make a point of going through them early every
203 morning and also at night. I am generally the last man, except the watchman, in the mills at night. In the morning, especially in winter, I go in to see that the gas is lighted in proper time, and if I see anything wrong I report it to the agent or request the overseer to do so. I do not stand between the overseer and agent. The object of my going through at night is to see that the gas is all out, the waste carried out, and that all is right.

Int. 4. If, in your inspections of the mill at any time during the day, you observe any unsatisfactory working in any of the mill-apparatus what do you do?

Ans. I, in the first place, find the overseer, and if he don't know it I tell him of it. If he does know it, I've nothing further to do, as I don't stand between him and the agent. He reports those things to the agent, or, if he requests me to do it, I do it for him.

Int. 5. How many operatives and how many spindles have you in the Atlantic Mills?

Ans. About 1,200 operatives; about 56,000 spindles.

Int. 6. Have you used in the Atlantic Mills lubricating oil furnished to you by Yeomans & Goss, of Boston?

Ans. We have.

Int. 7. When did you begin to use that oil?

Ans. I think in March, 1866.

Int. 8. Have you used it, as a rule, since that time?

Ans. We have.

Int. 9. About how many gallons a year have you used on an average since that time?

Ans. About 3,500.

Int. 10. Did you use in the mill, at any time before taking this oil, sperm oil alone as a lubricator?

Ans. Yes, sir; we did.

Int. 11. How has the Yeomans & Goss oil compared in operation as a lubricator with sperm in your mills, so far as your knowledge and observation extend?

Ans. Very favorably.

Int. 12. Which do the overseers prefer?

Ans. We have several departments in the mill; some of our spinners have preferred the Yeomans & Goss oil; other have never
204 expressed an opinion about it. Our carding-room overseers have never expressed an opinion as to which they would have. Our weavers prefer the Yeomans & Goss oil.

Int. 13. Did you ever use in your mill, before taking Yeomans & Goss oil, the paraffine lubricating oil made by the Downer Co., of Boston?

Ans. I never knew any such oil; never knew any by that name. We used a kerosene oil, bought of Downer & Co., for the purpose of lubricating.

Int. 14. Did you use it on your bearings generally, through the mill?

Ans. I think we did, sir.

Int. 15. Was it found objectionable in any respect?

Ans. It was.

Int. 16. State, so far as you can recall them, the objections found against it.

Ans. The first and principal objection was that it was not a good lubricator. We had a great deal of trouble with our spindles in the spinning-frames becoming rough and depositing a great deal of black sediment, apparently like iron filings mixed with oil. We found that the use of this oil destroyed the polished surface of the spindles. That was the main reason of its being discontinued, I think. The operatives complained, some of the odor, but many of them more especially of an eruption upon the skin, which they said it caused. There was also a deposit upon the windows.

Int. 17. When you first began to use the Yeomans oil, was it used in the bearings generally throughout the mill?

Ans. It was not. It was, after a time. It was worked in gradually, as we found the virtues of it.

Int. 18. At any time, after it came to be used on all the bearings of the mill, was its use on the spindles discontinued?

Ans. On the spindles of the spinning-frames? Yes.

Int. 19. State how long ago was this.

Ans. I should say the latter part of '68 or first of '69.

Int. 20. Has the use of the Yeomans oil in your mills at any time produced staining of the goods?

Ans. Not that I am aware of.

205 Int. 21. What description of goods is made in your mill and how important a matter is this staining in goods of that description?

Ans. We manufacture cotton goods—sheetings and shirtings. We manufacture the goods brown or unbleached. Staining would injure the sale of them.

Int. 22. What was the occasion of discontinuing the use of the Yeomans oil on the spindles of the spinning-frame?

Ans. A stain upon the goods.

Int. 23. Stains by what oils?

Ans. I cannot tell what oils, as we were using about that time that the stains were discovered one or two other oils as experiments.

Int. 24. What were the other oils that you were using about this time?

Ans. I think one was called the Eagle oil; the other I am not able to give the name of. It was a mixed oil, purchased of some parties here in Boston. By mixed oil I mean oil mixed of earth oil and fatty oil.

Int. 25. By what name has the Yeomans oil been furnished to your mills?

Ans. I think his invoices read, "Extra sperm lubricating oil."

Cross-examined by Chauncy Smith, esq., of counsel for complainants:

Cross-int. 26. Will you give the names of the overseers in your mill who have stated to you that they preferred the Yeomans oil to sperm oil?

Ans. Nathaniel R. French, George A. Smith, Samuel W. Knight, and Ivory G. Wakefield, who is not there now.

Cross-int. 27. Did they give you their reasons for preferring the Yeomans oil? And, if so, state what those reasons were.

Ans. The spinner told me his work run better with it; the weaver told me there was less wear on the cams with it; the carder told me that his rolls run better with it.

Cross-int. 28. Was it part of your duty to examine into the quality and working of the oils used and decide what should be used?

Ans. It was not especially.

Cross-int. 29. Did you make the purchases of the oils?

206 Ans. In part.

Cross-int. 30. What price have you been paying for the Yeomans oil during the last six months?

Ans. Seventy-five cents a gallon, I think.

Cross-int. 31. Are you now using or have you used during the past year any other oil than this Yeomans oil?

Ans. We have.

Cross-int. 32. What oil?

Ans. Sperm oil. Three barrels, I think, of Seccomb, Kehew & Thayer's; and I recollect having bought one barrel of oil, by the agent's request, of a young man named Bradley, representing some firm here in Boston.

Cross-int. 33. How much sperm oil have you bought and used during the past year?

Ans. I should say perhaps from 1,500 to 2,000 gallons.

Cross-int. 34. Did you use it unmixed with other oils, wholly or in part?

Ans. We use it unmixed except in one place.

Cross-int. 35. On what machinery do you use it unmixed?

Ans. On the spindles of the spinning-frames.

Cross-int. 36. On what machinery do you use it mixed?

Ans. It has been used mixed upon some of the heavy bearings of the shafting.

Cross-int. 37. With what do you mix the sperm oil for those purposes?

Ans. The only mixture that has been made to my knowledge was with the barrel we bought of a Mr. Bradley.

Cross-int. 38. Why do you use sperm oil on the spindles of the spinning-frames instead of the Yeomans oil?

Ans. In obedience to the orders of the agent.

Cross-int. 39. Do you know why the agent prefers the use of the sperm oil?

Ans. I only know by what he says.

Cross-int. 40. What does he say?

(Objected to.)

Ans. I haven't heard him say anything lately as to the reason why it is not used.

207 Cross-int. 41. When you did hear him say anything about the reasons, what did he say?

(Objected to.)

Ans. He said that though he was not satisfied that the Yeomans oil produced stains, it was better to discontinue the use of all kinds of earth oils from the spindles.

Cross-int. 42. You have not used in that mill any oil procured from the Downer Co. since about 1861, have you?

Ans. Not to my knowledge.

Cross-int. 43. And the oil which you used at that time, procured from that company, was bought as kerosene oil was it?

Ans. That was the name that I knew it by.

Direct examination resumed:

Int. 44. Was this kerosene oil called or known as Downer's spindle-oil?

Ans. My impression is that it was.

J. C. BOWKER.

Deposition of George W. Moore, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. George W. Moore; age, twenty-five years; residence, Somerville, Mass. I am an oil-merchant.

Int. 2. With what firm are you connected and how long have you been engaged in your present business?

Ans. I am one of the firm of Russell & Moore, Boston. Have been in the business about three and one-half years, as a member of that firm.

Int. 3. What classes of oils do your firm deal in?

Ans. We deal a great deal in paraffine. Coffin's paraffine we sell largely.

208 Int. 4. Do you obtain your Coffin oil directly from him?

Ans. We get it through Mr. Harris, his selling agent, but get it directly from Coffin's factory. Sometimes it has his brand on it, sometimes not. I have sometimes contracted with Coffin directly.

Int. 5. About how much Coffin oil have you had directly and indirectly from him, and disposed of, as nearly as you can judge?

Ans. I should think between 700 and 1,000 barrels, last year.

Int. 6. Have you sold it mixed with fatty oils, or unmixed, or both ways?

Ans. Both ways.

Int. 7. When mixed, with what was it mixed?

Ans. With sperm or lard oil.

Int. 8. In what proportions?

Ans. Generally from $\frac{1}{3}$ to $\frac{1}{2}$ of lard or sperm.

Int. 9. What proportion of your sales of the Coffin oil have been unmixed?

Ans. I should think it might have been 20 per cent.

Int. 10. To what kind of consumers have you sold this oil?

Ans. Cotton-mills, woollen-mills, machine-shops, sometimes paper-mills, and I have sold it for currying purposes.

Int. 11. What price on the average have you paid for the Coffin oil?

Ans. The prices vary. To-day we pay thirty-four cents, and I think we have bought it lower and higher.

Int. 12. Have you bought Coffin oil of more than one quality?

Ans. We have sometimes, but not generally. We have usually bought what he calls his common oil. The difference is in the color, one being a little lighter than the other.

Int. 13. Have the parties to whom you have sold the Coffin oil unmixed used it unmixed, or any of them, so far as your knowledge goes?

Ans. I remember one party that told me that they used it unmixed.

Int. 14. About how many different mills have you sold Coffin oil to, mixed or unmixed?

Ans. I should say from 150 to 200. It may be more or less.

Int. 15. What has been, so far as you know, the result of the use of the Coffin oil in these mills, whether satisfactory or not?

Ans. To the best of my knowledge it has always been satisfactory.

Int. 16. Does your firm sell wool-oil?

209 Ans. We do in some cases.

Int. 17. Have you sold any wool-oil of which the Coffin paraffine oil was an ingredient?

Ans. We have, but not very lately.

Int. 18. With what was the Coffin oil mixed for this purpose?

Ans. Saponified red oil.

Int. 19. Do you remember what kinds of woolen goods were made by the mills to which you sold this wool-oil containing Coffin's oil?

Ans. I know they used it in the hosiery-factories some.

Int. 20. What does the term heavy hydrocarbon oil mean, as used in the oil-trade, with reference to the presence or absence of naphthas and burning-oils?

Ans. I take it, the kerosene and benzine and lighter portions of the oil are taken out.

Cross-examination by Chauncey Smith, esq., of counsel for complainants:

Cross-int. 21. What is the name of the party to whom you sold the wool-oil containing Coffin's oil?

Ans. We have sold it to J. N. Tucker, of Gardner, Maine.

Cross-int. 22. What proportion of Coffin's oil did the mixture contain?

Ans. About one-half.

Cross-int. 23. What is the nature or character of the saponified red oil with which you mixed the Coffin oil?

Ans. It is a heavy, soapy oil, used in making soap considerably.

Cross-int. 24. Where and how is it obtained?

Ans. We buy it in Boston. It is made from lard and tallow.

Cross-int. 25. What quantity of it have you sold to the party you have named and at what price?

Ans. I don't wish to answer that question.

Cross-int. 26. Do you know for what this party used the oil?

Ans. For woolen goods. I think they manufacture satinets and cassimeres.

Cross-int. 27. Will you give the name of the party who told you that he used the Coffin oil unmixed?

Ans. The Neponset Cotton Co., Mr. J. W. Wattles, agent. Mr. Wattles told me.

210 Cross-int. 28. Do you know for what purpose he used it?

Ans. Yes, sir.

Cross-int. 29. Will you state what it was?

Ans. For lubricating the machinery of his cotton-factory.

Cross-int. 30. Will you give the names of some of the parties who have been the principal purchasers of the Coffin oil, unmixed, and also of some of them who have bought it mixed with sperm or lard oil?

Ans. Of those who have bought it unmixed, I should say the Granite Mill, Fall River; and the Neponset Cotton Co. of Canton. Of those who have bought it mixed, the Chase Mill Co., of Washington Station, R. I., and the Washington Mills of the same place.

Cross-int. 31. At what prices have you sold the mixed oils during the last year?

Ans. The price has varied. I should say from 80 cents to $1.00.

Direct resumed:

Int. 32. Why do you not wish to answer the question what quantity of the wool-oil made of Coffin oil and saponified red oil mixed you sold to the party named Mr. Tucker and at what price?

Ans. It is some time since we sold and I don't remember much about it.

Int. 33. You said in answer to 25th cross-interrogatory, "I do not wish to answer that question." Why do you not wish to answer it?

Ans. I don't wish to divulge my customers nor my price. I do not know the quantity which was sold.

GEORGE W. MOORE.

211 *Deposition of Thomas Leyland, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February* 1, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Thomas Leyland; age, 41 years; residence, Lawrence, Mass.; occupation, at present, dry-goods dealer.

Int. 2. Were you ever employed in the operations of the Union Coal & Oil Co.? If so, when and in what capacity?

Ans. I was in 1865, '66, and '67, at Cannelton and Maysville. At Cannelton I was superintendent of the crude-oil works, and at Maysville I was general superintendent of the whole works at both Cannelton and Maysville.

Int. 3. Please describe pretty fully the manner in which, during your superintendency, lubricating oil was produced from cannel-coal by that company.

Ans. The first process was the retorting, precisely the same as you make gas with the ordinary coal-retort. The vapors were collected and condensed, and then a portion of the tar was taken from it. It was then placed in a still for distillation.

Int. 4. How was the partial removal of the tar accomplished, and where was it done, and why?

Ans. The condensed vapor was collected in a large vessel called an agitator, added to which vapor was a certain proportion of sulphuric acid. This was done at the crude-oil works at Cannelton. One object was to save the transportation of that tar down to Maysville, where the refinery was.

Int. 5. At the refinery at Maysville, what was done with the product from which the tar had been so removed?

Ans. It was distilled or placed in a still with certain chemicals, heat applied and the oil vaporized and condensed, and what was left in the still run to coke. The chemical in the still was a solution of caustic soda, for the purpose of purifying—or to remove the heavy matter. The oil in the condenser was separated as it came off; the lighter oil
212 came off first; then what we call the middlings, and then the heavy oil. The heavy oil was then run to the paraffine room, where it was treated for the extraction of the paraffine; but before it went to the paraffine-room we treated it with sulphuric acid and caustic soda.

Int. 6. Was there any change in the process of producing this lubricating oil during your superintendency? If so, what was it?

Ans. The only changes were that we stopped the treatment with sulphuric acid at Cannelton and shipped everything, tar and all, over to Maysville. We also used a stronger solution of soda in the stills after that. We also made more middling; that is, cut off our light oils at a higher point, and run the middlings to a lower point than we had previously done. There were also some alterations made in the stills, relating to the application of fire under them and the placing of some safety-valves.

Int. 7. Will you explain what were the causes, so far as you know them, of the stoppage of the Union Coal and Oil Co. in 1867?

Ans. We couldn't get what it cost to make the oils.

Int. 8. Why did the production of the Maysville oil cost so much as compared with that of other oils that came in competition with it?

Ans. There was the cost of mining and retorting the coal in the first place, and the transportation to Maysville, and labor was very high at that time, and there was a Government tax on burning-oils, I think, of ten cents a gallon.

Int. 9. How did the introduction of lubricating oil made from petroleum affect the business of the Union Coal and Oil Co., as regarded selling-profits?

Ans. The petroleum was sold at such a price that the company could not compete; couldn't manufacture their oil at the price that some of the petroleum lubricating oils were sold for.

Cross-examination by Walter Curtis, esq., of counsel for complainants:

Cross-int. 10. Were you the sole superintendent of the works of the Union Coal and Oil Co. during the period that you were employed there?

Ans. No. I went at first to Cannelton as superintendent of the crude-oil works, and was there, I think, eighteen months. Then I was removed to Maysville, where I had charge of both Cannelton and Maysville.

213 Cross-int. 11. Where did you reside prior to going to Cannelton, and in what occupation had you been engaged?

Ans. At Lawrence, Mass.; I was traveling with an exhibition called the stereopticon.

Cross-int. 12. What chemical experience or education had you received prior to being employed by the company at Cannelton?

Ans. None whatever.

Cross-int. 13. Are you acquainted with Mr. Chapin, of Lawrence?

Ans. Yes, sir.

Cross-int. 14. Were you employed or engaged by Mr. Chapin to go down to Cannelton?

Ans. I was engaged by him to go there.

Cross-int. 15. What was Mr. Chapin's connection with the Union Co., if you know?

Ans. He was president of the company.

Cross-int. 16. Do you know whether he was a stockholder; and, if so, to what extent?

(Objected to.)

Ans. I don't know of my own personal knowledge.

Cross-int. 17. What was the yield per ton of oil from that coal?

Ans. I don't know. It is over three years since I have had anything to do with it, and I haven't thought a word about it since.

Cross-int. 18. Do you know whether or not the company that employed you owned the mine?

Ans. Yes; they owned the mine.

Cross-int. 19. In retorting the coal, did you have more than one retort over a single fire?

Ans. Yes; four.

Cross-int. 20. In describing the treatment which you made use of, I understood you to say that you treated the crude oil with acid before distillation; is this your meaning?

Ans. It is.

Cross-int. 21. You also used acids after distillation, did you not?

Ans. Yes.

Cross-int. 22. Did you afterwards redistil and again treat with acid?

Ans. Yes.

214 Cross-int. 23. How many times was this repeated?

Ans. Some oils we treated twice, and some, I think, only once, after distillation.

Cross-int. 24. Please state why caustic alkali was used in the still, and what its precise effect was as you understand it.

Ans. As well as I can answer, it was to remove from the oil some of the earthy impurities which were in it. By earthy I mean nothing that was oily in itself, but refuse or coke.

Cross-int. 25. You understood the alkali, then, to have an effect upon the coke, did you?

Ans. It hadn't any effect upon the coke, as I understand. It affected the oil.

Cross-int. 26. Do you mean to be understood as saying that the alkali aided in separating the coke from the oil or not?

Ans. Yes; I so understand it.

Cross-int. 27. Under whose advice or direction did you make use of it and subsequently increase the strength of the solution of soda used?

Ans. When I was removed from Cannelton to Maysville I was instructed to follow the directions of Luther Atwood.

Cross-int. 28. When did Mr. Atwood go into the employ of the company and how long did he remain there?

Ans. As near as I can remember, he came there some time in 1866, but I can't be sure. He remained there, I think, some six or eight months.

Cross-int. 29. What was his position and what were his duties while there?

Ans. If I remember right he came to introduce a new system of retorting coal, and, I suppose, the general improvement of the oil and the recovery of caustic soda. That is, I suppose, what he came for. There was no apparatus of the kind there, and he came to build it.

Cross-int. 30. How did the quality of the oil made before his coming compare with that made after his visit?

Ans. As I was not at Maysville before Mr. Atwood came there, I cannot say as to the quality of the oil at that time.

Cross-int. 31. Did he or not give you instructions as to the chemical treatment of the oil when you first took charge at Maysville?

215 Ans. Yes; my instructions were to see Mr. Atwood's orders obeyed.

Cross-int. 32. You speak of separating the oils at different gravities; at what gravities were they separated?

Ans. I don't remember.

Cross-int. 33. State as nearly as you can.

Ans. I don't think I could hit the mark very near; my memory is not good at figures, and I don't think I have thought of the matter since I left there.

Cross-int. 34. What did you do with what you term middlings?

Ans. We kept distilling them over again.

Cross-int. 35. You have stated that you couldn't obtain in '67 what it cost to make the oils. What did it cost?

Ans. That I can't remember.

Cross-int. 36. Was there any cost to the crude oil except that of mining the coal and retorting it? If so, what?

Ans. Not that I know of. There was also the cost of transportation to Maysville; that was a cent and a half per gallon. But there was a great deal lost. It was a very risky business, that of transportation. In some years it cost more than a cent and a half, a cent and three quarters, but I can't be particular as to the exact amount of the figures.

Cross-int. 37. What did you pay for labor in 1867, and what class of laborers did you employ, black or white?

Ans. We employed both. There were many different kinds of labor and many different prices.

Cross-int. 38. What were the different kinds of labor and what were the different prices paid for it?

Ans. Miners were paid at from $1 to $1.50 per ton; some of the rooms were more difficult to work than others, depending on the extension of the vein, etc. Drivers, dumpers, incline-men, cartmen, chargers, rakers, firemen, plug-drawers, watchmen or overseers, engineers, coal-breakers, laborers to wheel away the coke, and men to heat the oil were employed. The drivers we paid $9 per week as a general thing; dumpers the same; incline-men, $3 per day; cartmen, $1.25 and $1.50 per day, some were boys and some men; the chargers worked by the piece, at 8 cents a retort for charging; for raking, I believe 31 or 32 cents a

216 retort; firemen, $1.50 per day; plug-drawers, boys, $1 per day; watchmen, $4 for the principal one and $2.50 for the others; engineers, $3 per day; coal-breakers, $1.25 per day; laborers, at the general rate of $1.25 to $1.50 per day; men to treat the oil, we paid one $3 and the other $1.50 per day.

Cross-int. 39. About how many men in all did you employ; and did not those employees work in two or more capacities?

Ans. When I first went to Cannelton there were perhaps not more

than one hundred retorts in operation. I think the lowest number we employed was about one hundred and twenty-five and the highest about two hundred and thirty. The drivers were a separate gang; so were the firemen; our plugs were at the back of the retorts; and therefore we were obliged to have a separate gang of plug-drawers; the rakers and chargers perhaps worked in both capacities, as that work was done by the piece. The men who broke the coal afterwards wheeled the coke away. That made five different sets at the retorts. The mine was a different thing altogether.

Cross-int. 40. What was the cost of the lubricating oil when ready for the market?

Ans. I can't answer that question. As near as I remember, the cost of the manufacture of the crude oil delivered at Maysville was ten cents per gallon.

T. LEYLAND.

Deposition of Ira Cowee, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, Feb. 16, 1871.

Int. 1. State your name, age, residence, and occupation.

Ans. Ira Cowee; age, seventy-three years; residence, North Scituate, R. I.; occupation, superintendent of cotton-mill. For over fifty years I have been occupied in building and superintending cotton-machinery. I am now superintending the Scituate Manufacturing Co.'s mills. I have been in their employ thirty-three years—twenty-three years as superintendent.

217 Int. 2. What line of goods has been manufactured by that company during that time?

Ans. Since I have been superintendent print-goods have been the leading goods of the establishment. We have made a very few goods of other kinds.

Int. 3. Did you ever use, as a lubricating oil, in the Scituate Co.'s works, a paraffine and fatty oil mixed, bought of Bailey & Eaton?

Ans. Yes, sir.

Int. 4. Of whose manufacture was this oil?

Ans. I don't recollect.

Int. 5. When did you begin to use this oil in that mill?

Ans. The paper that I wrote to Bailey & Eaton would give the dates. We have a copy of it at the mills. I don't carry the date in my mind.

Int. 6. Can you say about how many years you continued to use this oil?

Ans. We used it as long as we could get it, but I can't tell how long it was, from memory.

Int. 7. How many spindles did your mill have at that time, and how many hands did it employ?

Ans. When we first commenced using this oil we had about one hundred and sixty looms. We added thirty-two afterwards, and more machinery—enough to run two hundred looms—about 8,000 spindles. We employed some over one hundred hands.

Int. 8. State the circumstances of your beginning to use this oil furnished you by Bailey and Eaton.

Ans. In the first place they called my attention to it, but it was a new thing, and I didn't think much of it. Finally I agreed to give it a trial. I became very well satisfied with the oil, considering it far better than the other oil we had been using—sperm oil. We commenced with it on our spindles, and went into the use of it gradually. After our spindles,

we used it on our shafting and on the bearings of our water-wheel. The oil that we had been using—the sperm oil—gummed our machinery; and when we commenced using this, it cleaned it all off, and the machinery ran lighter and better.

Int. 9. Did you make, or cause to be made, any special obser-
218 vations with a view to determine whether there was a saving in oil and in power by the use of the Bailey & Eaton oil as compared with sperm oil?

Ans. We did.

Int. 10. Did you state the results of these observations, as they were, in a letter which you wrote to Bailey & Eaton about that time?

Ans. I did.

Int. 11. Did you preserve a press-copy of that letter?

Ans. I did.

Int. 12. Have you examined that press-copy recently; and, if so, when?

Ans. I have. I was looking at it yesterday, and I've looked at it three or four times when looking over our copy-book.

Int. 13. Aided by that letter which you wrote at the time, are you able to state what the saving in oil and the saving in power was in the use of the Bailey & Eaton oil, as compared with sperm oil?

Ans. The saving in power was from twelve to eighteen per cent., and about the same in the quantity of oil. My copy-book will tell exactly. What I stated was as near as we could ascertain it. We didn't mean to call it any more than it was, any way, for we went into it very reluctantly.

Int. 14. Can you tell within a year or two when that letter to Bailey & Eaton was written?

Ans. I cannot tell you exactly. I can't recollect.

Int. 15. Was it before or after the year 1864, do you think?

Ans. 1863 or '64, I should think, but am not positive. I have the date on our record.

Cross examined:

Cross-int. 16. Mr. Bailey, of Bailey & Eaton, belongs in Providence, does he not?

Ans. Yes.

Cross-int. 17. Is he any relative or connection of your own?

Ans. No, sir.

Cross-int. 18. Who has been, during the time you have spoken of, the agent of your mill for the purchase of supplies?

Ans. Wm. M. Bailey was agent at that time, I believe.

219 Cross-int. 19. What connection is Wm. M. Bailey to the Bailey of Bailey & Eaton?

Ans. He is the father of the one that was in company with Eaton.

Cross-int. 20. Can you give the prices paid by your mills for that oil?

Ans. No, sir; I had nothing to do with it.

Cross-int. 21. Please describe carefully how the tests were conducted, by means of which you ascertained the comparative merits of the Bailey & Eaton and the sperm oils.

Ans. We have a mode of trying the water, by the proper machine, to ascertain how much water it takes for the water-wheel. Sometimes by measuring the water below the wheel, and sometimes by measuring it on the gate. That's the way we ascertain that fact. If the machinery runs easier, of course it takes less water to run it.

Cross-int. 22. You have stated two ways, as I understand you. Did you measure below the wheel or on the gate?

Ans. We tried it both ways. We are always trying our water, or frequently.

Cross-int. 23. Was that the only test to which you resorted in order to ascertain the comparative merits of the oils?

Ans. We ascertained in the early part by comparing the relative prices of the oils and the amounts consumed in a week or month.

Cross-int. 24. Did you compare the amount of power required when using Bailey and Eaton's oil with the amount of power required, after thoroughly cleaning your machinery, and using sperm oil?

Ans. We did. It always took less oil while we got the Bailey and Eaton oil.

Cross-int. 25. Did you mix the Bailey and Eaton oil yourselves or buy it mixed?

Ans. We bought it mixed.

Cross-int. 26. Do you know what it consisted of?

Ans. They never informed me how they mixed it.

Cross-int. 27. In testing the different oils, did you, at any time, return to the use of sperm after using the Bailey & Eaton oil?

Ans. No, sir.

Cross-int. 28. Did you cleanse your machinery before you began to use the Bailey & Eaton oil?

220 Ans. No, sir. We put it right in after the sperm.

Cross-int. 29. When did you cleanse it?

Ans. We never cleansed it any more than we always clean our machinery, once in six months. We clean our spindles, etc., of course, every day or two. We never cleansed it; we let one follow the other. We never have changed our general practice in cleansing our machinery.

Cross-int. 30. Mr. William M. Bailey took part in the tests you made to ascertain the amount of power used and amount of oil consumed with the different oils, did he not?

Ans. No, sir. That was a part he didn't have anything to do with. All supplies were ordered by him. He and Governor Smith were agents of the company. They never paid any attention to testing the power. They left all such things to me, and they said nothing to me about writing; it was the oil co. that wrote to me—Bailey & Eaton.

Cross-int. 31. Have you ever used in that mill any other paraffine oil besides the Bailey & Eaton oil; if so, what kind?

Ans. Yes; but I don't know of whose manufacture.

Cross-int. 32. Do you know from whom it was bought?

Ans. The company sent it out to me; I don't know where they got it; we have never used any sperm-oil since we commenced on the other.

Cross-int. 33. Don't you know how the barrels containing this paraffine oil last referred to were marked?

Ans. I don't recollect.

IRA COWEE.

221 *Deposition of F. E. Clarke, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February* 20, 1871.

Direct examination by Causten Browne, esq., of counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. F. E. Clarke; thirty-six years old; residence, Lawrence, Mass. I am manufacturing agent of the Pemberton Mills.

Int. 2. How long have you held that position?

Ans. Since June 8th, 1861.

Int. 3. How many spindles have the Pemberton Mills, and how many hands?

Ans. 28,000 cotton spindles and fourteen sets of woollen machinery. We employ eight hundred and fifty hands.

Int. 4. Are you manufacturing agent of any other mills than the Pemberton Co.'s mills; if so, of what?

Ans. Yes; of the Methuen Co.'s mills of Methuen, Mass., about two miles from Lawrence.

Int. 5. What is the number of spindles in the Methuen Co.'s mills and how many hands are employed there?

Ans. 12,000 spindles; three hundred and fifty hands.

Int. 6. What description of goods have been made during say the last five years at the Pemberton Mills, and what at the Methuen Mills?

Ans. At the Pemberton Mills, fancy cotton goods in variety, such as tickings, cottonades, checks, cotton-flannels, jeans, and skirtings, etc. In the woollen, cassimeres, repellants, shirtings, etc. At the Methuen, tickings and cotton flannels.

Int. 7. Are you using at the Pemberton Mills, or at the Methuen Mills, or both, a paraffine oil for lubricating? If so, how are the barrels marked?

Ans. Yes; they are marked "◇B◇ Spindle Oil."

Int. 8. Through whom have you bought this oil?

Ans. Joseph Barney.

Int. 9. Of whose manufacture does this oil purport to be?

Ans. Coffin's.

222 Int. 10. How long ago did you begin to use this Coffin oil, and in which of the mills you have mentioned?

Ans. In September, 1868, in the Pemberton Mills.

Int. 11. Did you afterwards put it in use in the Methuen Mills? If so, when?

Ans. Yes, in 1869; in the spring, I should say.

Int. 12. Since so putting it in use, have you continued its use?

Ans. I have.

Int. 13. Since so putting it in use have you used any other paraffine lubricating oil?

Ans. I have not.

Int. 14. About how much per week of this Coffin oil had been used since its introduction at the Pemberton, and how much at the Methuen Mills?

Ans. About one hundred and ten gallons at the Pemberton, and about twenty-five gallons at the Methuen.

Int. 15. When introduced at the Pemberton did you begin with using it mixed; if so, with what?

Ans. Yes; in proportion of twenty-five per cent. Cooper's neat's-foot oil to seventy-five per cent. Coffin oil.

Int. 16. If you afterwards began to use Coffin oil unmixed, about how long afterwards was it?

Ans. I think four months, but would not swear precisely.

Int. 17. Since that time, how has it been used at the Pemberton and Methuen Mills, mixed or unmixed?

Ans. Unmixed.

Int. 18. Has it been so used on all the bearings in those mills; and

if there is an exception, what is it, and what oil have you used on the excepted bearings, and why?

Ans. We have used it on all bearings except a large main shaft; upon that we use sperm-oil and tallow. I used it there because it is an important place, and having been successful with sperm, the bearings few, and the whole mill dependent upon them, I did not care to risk an experiment.

Int. 19. Have you observed any difference, and if so, in which direction, between the power required when using the Coffin oil for lubricating as compared with the power required when using sperm-oil?

223 Ans. No.

Int. 20. Have you observed any difference; if so, in which direction, as regards the comparative quantity of the two oils required per day or per week in lubricating the same amount of machinery?

Ans. I have compared it frequently and found no difference.

Int. 21. In applying the two oils respectively to a bearing, which oil spills from the bearing the most? I mean runs off and is lost in the act of covering the bearing.

Ans. Paraffine.

Int. 22. What has been the result of the use of the Coffin oil unmixed for lubricating, in the mills which you have mentioned, whether satisfactory or otherwise?

Ans. Satisfactory.

Int. 23. When you first used a paraffine lubricating oil in your mills, if you used any previous to Coffin's, was there any objection made to the pungent smell of the oil by the operatives?

Ans. There was not to my knowledge.

Int. 24. Has there been any trouble on that score in the use of the Coffin oil?

Ans. There has not.

Int. 25. Have you observed any deposit upon the windows of the mill during the use of the Coffin oil? If so, to what extent, and how much practical inconvenience has it occasioned?

Ans. Occasionally a slight deposit upon the windows, but no serious inconvenience. We might have to wash our windows once or twice oftener in six months than we would otherwise.

Cross-examined:

Cross-int. 26. You say the oil you have been speaking of purports to be Coffin's oil. Are the barrels so marked?

Ans. They are not.

Cross-int. 27. In what way, then, does it purport to be Coffin's oil?

Ans. By Mr. Barney's statements.

Cross-int. 28. You have no personal knowledge, then, whose oil it is?

Ans. I have not.

224 Cross-int. 29. Prior to the time when you began to use this oil, what other paraffine oils had been used in either of your mills?

Ans. I had used Seccomb, Kehew & Thayer's and Downer's.

Cross-int. 30. When did you cease to use Downer's oil?

Ans. I cannot say positively, but think in 1866.

Cross-int. 31. What prices have you paid for the oil you are now using, since you began its use?

Ans. Fifty cents per gallon, fifty-two and one-half cents, fifty-five cents, and thirty-nine cents; I believe those four prices.

Cross-int. 32. At what periods were those several prices?

Ans. We paid thirty-nine cents in '68, and part of '69, and the other prices at various times since—I couldn't say.

Cross-int. 33. What did you pay for the Downer oil in 1866?

Ans. I think it was sixty-five cents, but couldn't say positively.

Cross-int. 34. Are you the purchasing agent of those two mills?

Ans. Sometimes I purchase and sometimes others. The oils I have generally purchased, but I am not the regular purchasing agent.

Cross-int. 35. Who is the regular purchasing agent?

Ans. Nevins & Co., of Boston.

Cross-int. 36. Have you ever had any complaints at either of your mills with regard to the staining of woolen goods, while using the "◇B spindle oil"?

Ans. I have not.

F. E. CLARKE.

Deposition of Thomas B. Wattles, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 20, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Thomas B. Wattles; age, 35; residence, Canton, Mass.; occupation, superintendent of the Neponset Cotton Factory.

Int. 2. Before you went to the Neponset Co.'s factory, were you in charge of a mill elsewhere?

225 Ans. Yes; of a small mill at Suncook, New Hampshire. Mr. Bond and I ran it together for four years, from January, 1866, to January, 1870.

Int. 3. While running the Suncook Mill, did you use for lubricating the machinery a paraffine oil; if so, from whom was it obtained?

Ans. I used a paraffine oil, bought of Russell & Moore, of Boston.

Int. 4. Did you use it during the whole of the four years?

Ans. No; we used it in the year 1869, I think. We began its use then and used it until I left. I had been using sperm and Downer's spindle oil.

Int. 5. By Downer's spindle oil, do you mean what is known as the patent deodorized oil?

Ans. I only know it by its name, Downer's spindle oil.

Int. 6. Were you buying this Downer's spindle oil when you began with Russell and Moore's oil?

Ans. That was the last oil I used before Russell and Moore's.

Int. 7. What sort of machinery had you in the Suncook Mills?

Ans. Pickers, cards, dead spindle flier spinning frames, and flier twisters.

Int. 8. Did you use the Russell & Moore oil at Suncook mixed or unmixed?

Ans. Unmixed.

Int. 9. What was the result of its use, whether satisfactory or otherwise?

Ans. Mr. Bond, who staid at the mill all the time, told me it was the best oil he had ever used.

(Answer objected to.)

Int. 10. Was this Russell & Moore oil, as it came to the Suncook Mill, unmixed paraffine oil, or was it mixed with fatty oils?

Ans. I always understood it was unmixed. I bought it for pure paraffine.

Int. 11. State, if you know, how this Russell & Moore oil, as used unmixed at Suncook, compared with sperm oil, as regards the quantity used

and power required, and the behavior of the oil generally as a lubricator.

Ans. My experience was that I used about one-third more of paraffine than I did of sperm, but there was less gum than with
226 sperm; and that was the reason it was liked, because the heavy fliers on the spindles would gum up with sperm, and with paraffine they did not. I've no means of knowing as to the power, for we had plenty of power. We gave the preference to the paraffine, because there was no gum.

Int. 12. Now in regard to the Neponset Company's Mill, have they used there a paraffine lubricating oil, furnished by Russell & Moore?

Ans. Yes.

Int. 13. Have you used it unmixed, or have you mixed it with fatty oil?

Ans. We mix it half and half with lard oil.

Int. 14. Who is the agent of that mill having the directing of the oil to be used?

Ans. Joseph W. Wattles.

Int. 15. How long has that oil been used there for lubricating, if you know?

Ans. Only one year, of my personal knowledge; that's all the time I have been there. I found it in use when I went there.

Int. 16. Do you know of any reason why it is used there mixed with lard oil instead of being used unmixed?

Ans. I don't. That's the result of my brother's experiments. He arrived at that conclusion, and told me to keep on in that way.

Int. 17. What sort of goods are made at the Neponset Mill?

Ans. Cotton print cloths.

Int. 18. Since you have been superintendent of that mill, what has been the result of the use of this oil, whether satisfactory or otherwise?

Ans. It has given perfect satisfaction.

Cross-examined:

Cross-int. 19. When did you begin to use Downer's spindle oil at Suncook?

Ans. I think in 1868. I couldn't state positively.

Cross-int. 20. What price did you pay for the last you bought of that oil?

Ans. I think one dollar a gallon.

Cross-int. 21. What price did you first pay for the oil you bought of Russell & Moore?

Ans. I think forty five cents.

227 Cross-int. 22. Were Mr. Bond and you running the Suncook Mill on your own account?

Ans. Yes, sir.

Cross-int. 23. Was the enterprise successful or otherwise?

Ans. No, sir.

Cross-int. 24. Who purchased the oil for the Neponset factory?

Ans. Joseph W. Wattles.

Direct resumed:

Int. 25. Was the Downer spindle oil which was used at Suncook bought unmixed or mixed with fatty oil?

Ans. It was represented to me to be a mixture, but I did not know of what.

Int. 26. Why was not the Suncook enterprise successful?

Ans. Because the goods were sold in the spring for less than it had cost to make them all through the winter.

Int. 27. If you know, from your own observation and experience, in what respect, if any, the Russell and Moore oil, used at Suncook, was preferable to the Downer spindle oil, please to state what you know.

(Objected to.)

Ans. I know that it didn't gum so much on the spindles.

(Before the last question was put, the counsel for respondents stated that it was a question which had been inadvertently omitted on the direct examination.)

Cross-examination resumed:

Cross-int. 28. (De bene esse.) How do you know that Downer's spindle oil gummed more than the Russell and Moore oil?

Ans. From my own personal observation while at work upon the machines.

Cross-int. 29. The same was true of sperm oil, was it not?

Ans. Yes; I considered the Downer oil better than the sperm; less gum.

Cross-int. 30. How did the Downer oil and the Russell and Moore oil compare in odor?

Ans. I should think there was the strongest odor to the Russell and Moore oil.

T. B. WATTLES.

228 *Deposition of Jonathan Smith, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February* 24, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Jonathan Smith; age, 45; residence, Newburyport, Mass.; occupation, agent of the Peabody Mills.

Int. 2. What line of goods are manufactured at that mill, and how long have you been agent there?

Ans. Print cloths and sheetings. I have been agent three years the 23d of January last.

Int. 3. At any time, since you were agent of that mill, have you had and tried the Downer spindle oil, so called?

Ans. I have.

Int. 4. State the circumstances of your first becoming acquainted with that oil.

Ans. Through an agent of the Downer Kerosene Oil Co. named Lovering. He called and brought me a sample of oil, and wished me to try it; he brought me at first a bottle of the oil to show me what the oil would be when sent. I ordered a number of barrels, I think six. I bought it on his representation as being equal to sperm.

Int. 5. Have you here the bottle of oil which he so brought you as a sample?

Ans. That is the bottle of oil that he brought me, the original package, with the label on it. (The bottle is produced, and marked "Respondents' Exhibit 27a.")

Int. 6. State as nearly as you can when this person came and brought you this bottle.

Ans. It is two years since, but I can't tell you whether it is more or not; it is as much as that, I think.

Int. 7. When did you take charge of that mill as agent?

Ans. I went there and commenced three years the 23d of January last.

229 Int. 8. Was this oil which you bought after the sample, Exhibit 27a, the first oil that you used in that mill for lubricating after you took charge of it?

Ans. It was not.

Int. 9. What other oil did you use first?

Ans. Oil that I found there in the oil-tanks.

Int. 10. How long do you think you were in using up that oil that you found there?

Ans. Allow me to say that we began by repairing up the mill and didn't get it started till May, nor in full operation till July. I should say we were some months in using up the oil on hand.

Int. 11. You say you ordered six barrels, you think, of oil according to sample Exhibit 27a. Did you receive those barrels?

Ans. I did, by freight.

Int. 12. If you paid for them, state to whom you paid.

Ans. I paid at the Downer Kerosene Co.'s office in this city.

Int. 13. How were these barrels marked, as nearly as you remember?

Ans. "Downer's spindle oil." I can't tell whether there was anything else or not.

Int. 14. If the agent, Mr. Lovering, when he made this sale of the six barrels to you, or when he showed you the sample, said anything about its being a new oil, please state what he said.

Ans. He said it was Downer's new series of oils.

Int. 15. For what purpose or use did he sell it to you?

Ans. As a lubricator, to use in any place that I had been using sperm.

Int. 16. Did you use these six barrels, or thereabouts, of oil for lubricating in your mill?

Ans. I did.

Int. 17. Did you use it just as it came, or did you mix it?

Ans. Just as it came.

Int. 18. Did you use it throughout the mill, on all the bearings?

Ans. I did.

Int. 19. How did it work?

Ans. There didn't appear to be body enough to it, so that our spindles became dry very soon after oiling.

230 Int. 20. State what your course was in putting this oil in use in the mill, so as to obtain impartial reports from the overseers.

Ans. I didn't tell the overseers that I had changed the oil. After running a time—perhaps two or three weeks—one of my overseers came and said, "Have you the same oil you've been using?" I said, "Yes, the same oil we've been using." He says, "There's something wrong about it. It is not as good as that we've been using until within a few weeks." I asked him why. He said, because he had to oil oftener than before; using from one-third to one-half more oil than he had been using. I asked him how he could tell that he was using more. He says, "On my fly-frames, where I oiled once in two weeks, I oil once in a week, and down to once in two days, because my spindles kept squeaking." I continued the use of this oil till it was used up.

Int. 21. In the discharge of your duties as agent of the mill, did you personally observe the working of this oil? If so, state the results of your own observation.

Ans. I did; from being called to it by the overseers, I found there

was continual squeaking of the spindles, both of fly-frames and ring-spindles, which is the hardest place to test oil of that kind. I did not use it on my shafting at all, having doubts as to its having body enough to lubricate them well. There was a complaint of gum or sticky substance on the rails wherever it flowed over.

Int. 22. Was the oil which you found in the mill when you went there, and which you used up before buying this Downer oil, a paraffine lubricating oil?

Ans. I should say it was. It was mixed, when I got there, in the tank.

Int. 23. Did you have a second visit from any agent of the Downer Co. to sell you lubricating oil; if so, who was the party who came there?

Ans. Mr. Lovering came again and wished me to buy oil, and I told him the result was so unsatisfactory that I wouldn't take any more. He wished to know in what way it was unsatisfactory, and I gave him the same reasons I have given in this deposition.

Int. 24. After that did any agent of the Downer Co. come to sell you oil; and, if so, who?

231 Ans. A Mr. Greene, I think his name was; a son-in-law of Mr. Downer.

Int. 25. Did he bring you a sample, and, if so, what representation did he make in regard to it?

Ans. He did. He represented that I could use it in any place where I could use sperm. I told him the unsatisfactory nature of the former trial, and he said that this was a heavier-bodied oil and that I could use it even in my cylinders. I told him I didn't want to try it at all, and upon his urging me to try it, saying he wished to send me one barrel, that he would make no charge of it, and if it did not prove as satisfactory as he had represented that he would give it to me, I told him I didn't want to take it on that basis, but he urged me very much, and I consented at last, telling him I should be guided entirely by my judgment.

Int. 26. Did you receive and try the barrel of oil accordingly?

Ans. I did.

Int. 27. With what result?

Ans. After using a small part of it I threw it out.

Int. 28. How did it compare with the other six barrels?

Ans. I didn't use it anywhere except on the cylinders, where he recommended it so highly. That's why I got so quick a trial of it.

Int. 29. After you got through using the first six barrels of this Downer spindle oil, what lubricating oil did you adopt for use in the mill?

Ans. An oil I bought of an agent of Yeomans and Goss.

Int. 30. Was it Yeomans' extra sperm lubricating oil, so called?

(Objected to.)

Ans. Yes.

Int. 31. Has that been the regular lubricating oil used in your mill since that time?

Ans. I've used that most of the time.

Int. 32. What has been the result of its use, whether satisfactory or otherwise?

Ans. Mainly satisfactory. One lot I sent back.

232 Cross-examined:

Cross-int. 33. Before going to the Peabody Mills, what experience had you had as a mill agent, if any?

Ans. I was superintendent. I never was agent till I went there.

Cross-int. 34. How many spindles do you run at the Peabody Mills?

Ans. A few spindles less than 19,000.

Cross-int. 35. Have you ever had any complaints made in regard to the odor arising from any paraffine oil you have used at those mills?

(Objected to.)

Ans. No, sir.

Cross-int. 36. State what prices you have paid for the oil you testified you bought from the agent of Yeomans & Goss.

Ans. At first one dollar; for the last ninety cents.

Cross-int. 37. What did you pay for the six barrels of Downer's spindle oil?

Ans. I can't tell you; but either fifty, sixty, or sixty-five cents. Those prices have all been given me by their agents. My books would tell.

Cross-int. 38. You used the Yeomans oil mixed or unmixed?

Ans. Just as he sent it.

Cross-int. 39. Was it represented to you as a mixed or an unmixed oil?

Ans. The first I bought was represented as unmixed; after that as a mixed oil.

Cross-int. 40. Of what was it represented to be composed?

Ans. Paraffine and sperm or tallow.

Cross-int. 41. From what you saw of the first lot of what you bought from Yeomans, did you believe the oil to be unmixed, as represented, or mixed?

Ans. I believed it to be unmixed.

Cross-int. 42. Is it any part of your duty as agent to superintend the oiling of the fly-frames or any other part of the machinery of the mill?

Ans. No, sir.

233 Cross-int. 43. Do you know of your own knowledge, from what you actually saw, anything about how often the fly-frames were oiled when using Downer's spindle oil, and how often when using the other oil?

Ans. I do.

Cross-int. 44. State what you know.

Ans. My first order was to oil the speeders, or fly-frames; to have them oiled once in two weeks—the spindles. They were so oiled until we got this Downer oil, and until the overseer complained to me that the oil would not run that length of time. I told him to oil them as often as he thought best. He came and told me that he was oiling them once a week, and that would not do. He says, "I have oiled them this morning." I went with him to the frames, made an examination of the spindles, and told him to let me know when he thought they ought to be oiled again. After running three days he told me they were squeaking badly. I went with him to the frames and saw that they should be oiled again, and they were oiled at that time in my presence. I examined them every day—that is, I was amongst them every day, but did not make an examination only by the ear, by the sound, and they began to squeak, and were oiled two days from that time.

Cross-int. 45. Prior to purchasing the Downer oil, did you see the spindles oiled whenever it was done?

Ans. No, sir.

Cross-int. 46. How do you know of your own knowledge how often it was done?

Ans. I do not know only as my overseers reported.

Cross int. 47. What oil are you using now at the Peabody Mill?

Ans. Paraffine and sperm, mixed.

Cross-int. 48. Of whom do you buy it?

Ans. I buy both kinds of Yeomans and Goss. The last that I bought before that was of another party.

Cross-int. 49. Who did you buy of before that?

Ans. Of Bradshaw & Patch, of Boston—the sperm; the paraffine of Seccomb, Kehew & Thayer.

Cross-int. 50. Was the last you bought of Yeomans & Goss bought mixed or unmixed?

Ans. Unmixed.

234 Cross-int. 51. Your objection to the Downer spindle-oil was that it didn't last as long as the oil you had been using before that, was it not?

Ans. Yes.

Cross-int. 52. If you know from whom that oil in use before was bought or of what it was composed, please state.

Ans. I don't know anything about it.

Direct resumed:

Int. 53. Was the fact that the Downer spindle oil didn't last as long the only objection to it? If any other, what?

(Objected to as not proper on redirect examination.)

Ans. I don't think there was any other objection why I should not have used it.

Int. 54. If there was any other objection whether it would or would not have deterred you from using it, state what it was.

(Objections as before.)

Ans. There was another objection—the gum; but I hardly know whether I should have discarded it for that or not, not having tried it long enough.

JONA. SMITH.

Deposition of Francis Maguire, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, February 27, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Francis Maguire; age forty-seven; residence Cambridge, Mass.; occupation, oil and candle dealer and manufacturer.

Int. 2. You have testified, when called as a witness for the complainant, that you have used the Merrill deodorized oil, so called, chiefly as a wool oil, combined with fatty oil. Have you used it combined with any other than a fatty oil for the purpose of a wool oil?

Ans. No, sir.

235 Int. 3. With what fatty oils have you combined it for a wool oil?

Ans. Olive oil, chiefly; I have experimented with other oils, but I use olive oil.

Int. 4. Is olive oil a fatty oil?

Ans. Yes, sir; that is, it is a fat vegetable oil, not a fat animal oil.

Int 5. You testified that you combined the Merrill oil in the proportion of one-fourth fatty oil to three-fourths of the Merrill oil. How

much has the composition varied in each direction, if at all, from these proportions?

Ans. No material variation.

Int. 6. Is your wool oil sold under the name of the Maguire patent wool oil?

Ans. It is sold as Maguire's wool oil. There is no word "patent" upon it. I have no patent on it.

Int. 7. You testified that the paraffine oils, which you knew of before Merrill's deodorized oil, were considered by you to be objectionable for wool use, because, by reason of the volatile oils which they contained, they were more liable to smell and give off vapors and odors at a low temperature. What do you mean by a low temperature? Under what conditions in the use of the oil is the temperature you refer to reduced?

Ans. I mean that there was a smell arising from these oils at the ordinary temperatures to be found in manufacturing establishments; that is, there was a disagreeable smell arising from these oils that seemed to be inherent in the oils, which smells arise owing to the presence of these volatile matters.

Int. 8. You refer to the temperature of the rooms in which the oil is used, if I understand you?

Ans. Yes, sir.

Int. 9. You testified that the mixing of Merrill's oil with lard and whale oil has an effect, from the antiseptic nature of Merrill's oil, to improve both the oils for lubricating purposes. State what the nature of that improvement is.

Ans. It renders them less liable to become sticky and gummy on the machinery, and gives no other smell than that belonging to each of the fatty oils mentioned.

Int. 10. Have you any agents for sale of your wool oil? If so, please give their names and residences.

236 Ans. Messrs. J. A. Treat & Co., of Lawrence, are the only regular agents I have.

Int. 11. If there are any dealers who sell your oil besides Mr. Treat, or any agents for the sale of it whom you do not consider regular agents, will you give their names and residences?

Ans. No other agents or traders.

Int. 12. Will you give the names of the parties who have bought your wool oil besides Treat & Co.?

Ans. Is it necessary that I shall do so?

Int. 13. I ask the question. Do you refuse to answer it?

Ans. Unless ordered by the court to do so.

Int. 14. Speaking of your wool oil, in your former deposition, you said, "There has been no complaint whatever from parties who have used it." Is that statement strictly true?

Ans. It was true then. I have had one complaint since.

Int. 15. Only one?

Ans. That is all.

Int. 16. And who was the party that complained?

Ans. I have the same objection to answering questions of this kind that I have to the other one.

Cross-examination declined.

FRANCIS MAGUIRE.

237 MARCH 25, 1871.

Chauncey Smith appears as counsel for complainant, and William Bakewell for the respondents.

The respondents offer in evidence letters-patent granted Herbert W. C. Tweddle, No. 34324, dated February 4, 1862, for improved apparatus for distilling petroleum or other hydrocarbon oils, the same being a certified copy from the United States Patent-Office, marked "Respondents' Exhibit No. 29, J. H. B."

Also, certified copy of letters-patent granted to Herbert W. C. Tweddle, November 27, 1866, being re-issue 2404 of letters-patent No. 34324, of February 4, 1862, marked "Respondents' Exhibit No. 30, J. H. B."

Also, letters patent granted to Herbert W. C. Tweddle, dated December 10, 1867, No. 72126, for improvement in distilling hydrocarbon oils, marked "Respondents' Exhibit No. 31, J. H. B."

Deposition of H. W. C. Tweddle, taken, subscribed, and sworn to before J. H. Bailey, examiner, March 25, 1871.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Herbert W. C. Tweddle. My age is about thirty-nine years. My residence is city of Pittsburg, State of Pennsylvania; and my occupation is manufacturer and refiner of petroleum and manufacturer of lubricating oils.

Int. 2. State where you were born, and what is your profession?

Ans. I was born in Liverpool, England, and my profession is that of a chemist.

Int. 3. State for what profession, if any, you were educated; whether or not you have made chemistry a special study.

Ans. I studied for a physician. I have made chemistry a special study, in its application to manufactures, since 1849.

Int. 4. State whether you have had your attention directed to the distillation and refining of oils and fats, and since what time.

238 Ans. I have had my attention directed to the manufacture of oils and fats by distillation, refining, and otherwise, since 1849.

Int. 5. When did you first come to this country?

Ans. Early in 1853.

Int. 6. Previous to your coming to this country, what description of oils were you particularly acquainted with the distillation of?

Ans. Rosin oil, palm oil, turpentine, and with the refining of almost all oils then known in commerce.

Int. 7. Had you anything to do with the distillation of coal oils or of the oils from coal?

Ans. Coal-tar, and with its distillation. I have made the chemistry of gas-making a study.

Int. 8. What business were you engaged in during the years 1851 and 1852, and where?

Ans. I was engaged in Liverpool, England, as an assistant to my father, who had large works, manufacturing soaps, refining oils. He also made sulphuric acid and other acids.

Int. 9. State whether or not you had, during the time referred to, any practical acquaintance with the refining and bleaching of oils.

Ans. Yes; that was my principal business.

Int. 10. Did your business include the treating of animal oils; and, if so, what?

Ans. It did. Tallow, lard, whale, cod, and almost all kinds of animal oils then known in commerce came under my hands.

Int. 11. State whether or not the manufacturing and refining operations of the establishment you were then connected with were extensive or otherwise.

Ans. They were extensive.

Int. 12. During the first few years of your residence here, how were you engaged, and where?

Ans. I was engaged generally in instructing manufacturers in the application of chemistry to the refining of oils, fats, soaps, etc. I was engaged in New York; in Providence in 1856. In 1856 and 1857 I think I was engaged in the manufacture and refining of cotton-seed oil, both in Providence and in St. Louis.

Int. 13. State whether or not your attention was at that time directed especially to the bleaching of any, and what kind of, oils.

239 Ans. At that time my attention was directed specially to cotton-seed oil. I was the first person, I believe, who was able to bleach cotton-seed oil white.

Int. 14. You have stated that you were engaged in St. Louis; please state when and how?

Ans. In 1857 I undertook the management of large cotton-seed oil works in St. Louis for Wyman, Grant & Co. I put their works in active operation, and was actively engaged manufacturing cotton-seed oil, linseed oil, castor oil, peanut oil, and refining the same.

Int. 15. Have you been connected with the construction and operation of rosin-oil works, and when and where?

Ans. I went to New Orleans in 1858. I was engaged by Mr. Peet to conduct a series of experiments in distilling and refining rosin oil. I was engaged several months on these experiments. I distilled rosin oil, coal-tars, and fats, and vegetable oils by fire and superheated steam, under atmospheric pressure and in vacuo. The object of these experiments was for the purpose of finding out some means by which rosin oil could be made a good burning oil, a good lubricating oil, to deodorize it perfectly, and make it perfectly white. These experiments were very costly and elaborate. I afterwards finished the erection of the Louisiana Oil-Works and put them in active operation. They were for the distillation of rosin oil on a very large scale.

Int. 16. What was the success or otherwise of your experiments on rosin oil?

Ans. My experiments were successful in perfectly deodorizing it and making it white, and only partially successful in making it burn and lubricate.

Int. 17. What were the means employed by you for deodorizing and decolorization of rosin oil for lubricating purposes?

Ans. First, I distilled the oil by fire; then I distilled it by fire and superheated steam in vacuo. I also used chemical means as well to deodorize it; these are two distinct processes. I did not use chemical means after distilling the oil. In the early stage of distillation I separated the naphtha and light oils.

Int. 18. Was the chemical process you have referred to a step in the process of distillation for the deodorizing and decolorization,

240 or was it the separate process you have referred to for effecting the same or similar results?

Ans. It was a separate process of distillation for accomplishing the same results.

Int. 19. Was the rosin oil, which you thus treated in order to remove the odor and color, a distillate?

Ans. It was.

Int. 20. Referring to the process of distillation as distinguished from the chemical treatment referred to, what was the effect upon the oil distilled over, and what was the character of the residuum in the still, if

there was such residuum? I mean the effect as to color, and odor, and lubricating qualities.

Ans. Suppose you make the question distillations; understanding it so, I will proceed to answer it. After the primary distillations by fire and the separation of the lighter oils, I found that by distilling with superheated steam in vacuo, with or without auxiliary fire, the products of distillation were much better deodorized than if I had used fire alone. I am not prepared to speak as to their lubricating qualities being improved. The residuums of the secondary distillation had much less odor than when the distillate was introduced into the still, when the operation was not carried too far.

Int. 21. State when you first made experiments or trials in relation to petroleum as distinguished from oils produced from the distillation of coal.

Ans. In 1859 I made many distillations on a small scale with petroleum to investigate its properties. I found that by mixing it with rosin oil I improved the burning qualities of the rosin oil and it retarded the tendency of rosin oil to gum.

Int. 22. State whether you had anything to do with the construction or operation of any other chemical works in New Orleans.

Ans. I constructed the Pelican Chemical Works in 1860, and put them partially in operation. I took sick late in the summer of 1860, and left New Orleans early in 1861, intending to go to Europe. I was in bad health at the time.

Int. 23. Where did you go from New Orleans at that time?

Ans. I came up the river, stopped at Memphis, and called on Capt. James A. Grant. He gave me some letters of introduction to
241 David Richie and Joshua Hanna, of Pittsburg. He desired me to go by the way of Pittsburg to New York and learn particulars and extent of the production of crude petroleum. I promised to do so and let him know about it.

Int. 24. Did you come to Pittsburg and make the investigation spoken of as to petroleum, and with what result?

Ans. I did. I called in Pittsburg on the before-named gentlemen; also on Mr. S. M. Kier, who was the largest and the first distiller of petroleum oils in the country.

Int. 25. Where were Kier's petroleum-works situate?

Ans. Mr. Kier's works were on Seventh street, Pittsburg, above Grant street, and at Freedom, Pennsylvania, down the Ohio River.

Int. 26. Did you visit either of those works? If yea, state what apparatus and process of distillation Kier employed at that time.

Ans. Mr. Kier took me himself to visit the Seventh-street works. They had three small twenty-five-barrel stills. This was in February, 1861. They distilled the petroleum first by fire-heat, separating the benzole or naphtha; they then refined the distillate by sulphuric acid and alkali; they then redistilled the treated oil by naked fire, and retreated the distillate with sulphuric acid and alkali. The product was burning oil; the residuum left in the stills from the first operation was tar and coke; the residuum of the second distillation they redistilled.

Int. 27. In your last answer you say they distilled petroleum, separating the naphtha; they then refine the distillate by sulphuric acid and alkali. What do you mean by the distillate; do you mean the naphtha? If not, you have not stated how the distillate was obtained. Please do so.

Ans. I do not mean the naphtha. I mean after the naphtha is separated and the distillate run from the condenser, having a gravity of about

sixty Baumé, the distillate is then run into a separate tank, down to thirty-eight or forty Beaumé. That between sixty and forty Beaumé is known as the burning-oil distillate.

Int. 28. State whether or not you made at that time, or about that time, any, and, if so, what, suggestions to Mr. Kier, as to modification or alteration of his apparatus for distilling petroleum.

Ans. I suggested several improvements. I suggested the use of
242 superheated steam as an auxiliary to fire, to facilitate his distilling operations, also the use of superheated steam in vacuo.

Int. 29. State whether or not these suggestions thus made by you, or any, and which of them, were carried into practical application at Mr. Kier's works, and at what date, if at all.

Ans. Late in February or early in March, 1861, I introduced into one of Mr. Kier's stills, at the Seventh-street works, partially-superheated steam to assist in the distillation of the first distillate; I mean the distillate before mentioned as running from sixty to thirty-eight Beaumé.

Int. 30. Did this involve any, and, if so, what, alteration in or addition to the distilling-apparatus as previously operated at Kier's works?

Ans. I introduced a steam-pipe direct from the steam-boiler into the twenty-five-barrel still in the still-house nearest Seventh street. I ran this pipe several times round and round the interior of the still, terminating the pipe with a pipe extending the whole length of the still; this pipe was perforated along its length with numerous small holes. I also re-arranged the furnace and flues under the still so as to enable the workmen to prevent the flame or the heat striking on the sides of the still when the distillation gets low. The upper flues could be shut off with dampers at pleasure. There was a valve on the steam-pipe, so as to control the admission of steam, and another small valve so placed as to prevent water from the condensed steam being carried into the still when the steam is let on.

Int. 31. State whether this apparatus which you have just described includes or was furnished with stop-cocks for regulating its operation.

Ans. It was.

Int. 32. Which of the apparatus described in your answer to interrogatory 30 was present in the apparatus in use at Kier's works before making the alteration you have referred to?

Ans. The still, the condenser, the condense-tank, and the furnace were old; the steam-pipe, the valves, and fittings were new.

Int. 33. Under whose directions were these alterations or additions made to the distilling-apparatus at Kier's works?

Ans. Under my own personal supervision.

Int. 34. Was this improved apparatus put in practical operation at those works, and when?

243 Ans. It was put in practical operation in March, 1861, and proved to very much enchance the rapidity of the distillation and improve the oil.

Int. 35. Have you had a drawing or sketch made of this apparatus as improved by you? If yea, please produce it.

Ans. I have had a drawing made, as near as possible, like the apparatus I then made. I here produce the drawings, marked Respondents' Exhibit No. 32.

[Adjourned to meet at the same place on Monday next, at 10 o'clock, a. m.]

FEBRUARY 27, 1871.

[Met pursuant to adjournment. Present as at last meeting.]

Resumed:

Int. 36. Examine the drawing, Exhibit No. 32, and explain the apparatus briefly by reference to the letters marked on it.

Ans. A is an iron-still; this still—the original still—contained about twenty-five barrels; B is the goose-neck; C, condense-pipes; D, condense-tank; E, gas-trap; F, gas-pipe for the escape of non-condensable gases; G, steam-pipe, to lead steam from steam-boiler; H, small cock for drawing off condensed water from steam-pipe before admitting steam into the still; I, valve to admit steam into the still; J J J J, steam-pipes circulated round the still to partially superheat the steam; they are continuous from the pipe G, and end in a perforated pipe, K, running the length of the still; L is the furnace; M, side-flue, which can be shut off by dampers, not shown in the drawing; N, cock for drawing off tar or residuum from the bottom of the still; O, pipe through which oil is discharged from the condense-pipes.

Int. 37. State whether the pipes J J circulate inside or outside of the still.

Ans. Inside.

Int. 38. By what means is the steam, passing through the pipe J J, partially superheated?

Ans. The steam is superheated by contact with the hot oil in the still, which is heated by the furnace underneath.

244 Int. 39. State whether or not it is so heated while in the pipe J J, before passing out of the perforated pipe.

Ans. It is partially superheated while passing through the pipe J J, before passing out of the perforated pipe K.

Int. 40. Examine letters-patent to Joshua Merrill, No. 90284, dated 18th May, 1869, and state in what way the steam is superheated or partially superheated in that apparatus.

Ans. In exactly the same way as described in the apparatus put up by me for S. M. Kier.

Int. 41. Did you suggest to Mr. Kier any other improvements in the distillery apparatus at his works at or about that time?

Ans. I suggested the distillation of crude petroleum in vacuo, with the aid of superheated steam.

Int. 42. State whether you made or carried into effect any and what improvement or modification in the process of distillation or treatment of petroleum at his works, either in Pittsburg or at Freedom, during the year 1861.

Ans. Mr. S. M. Kier, after I had put the Seventh-street apparatus at work, engaged me to improve and enlarge his works at Freedom. I introduced into two stills the superheated coil, with its steam-pipe, outlet-pipe, stop-cocks, arranged substantially as described in Joshua Merrill's patent, No. 90284, dated May 18, 1869. I then built two large one-hundred-barrel stills, and two of smaller capacity; two superheating furnaces, with superheaters, to superheat steam by the direct action of fire; the steam being passed through a cast-iron coil, and then being passed into the still, and distributed through perforated pipe through the oil to facilitate distillation. I improved his manufactory generally, inasmuch as making burning oil by one distillation instead of two distillations, and one refining process by chemicals instead of two refining processes, as they had formerly used, making white merchantable oil. This was done in March, April, and May, 1861.

Int 43. Have you any model which represents substantially any part or portion of the apparatus at Kier's works, as improved by you? If so, please produce and describe it.

Ans. I have a model which represents pretty closely the apparatus put up at Kier's works at Freedom, which I here produce, (marked Respondents' Exhibit No. 33, J. H. B.) It represents a cast-iron
245 still set in brick-work, with a furnace underneath. There is a coil of pipe, circulated in the interior of the still, through which superheated steam passes, having an inlet-cock and an outlet-cock. There is another pipe, which passes down to the centre of the bottom of the still, ending in radial pipes, which are perforated with numerous small holes. Superheated steam passes through this pipe and passes into the oil, and facilitates distillation. The vapors of the oil, being distilled, are carried over by the goose-neck to the condenser, placed in a tank of water. The condensed products flow away by an appropriate pipe to their respective tanks. I put up in Mr. Kier's works, at Freedom, four sets of apparatus, embodying substantially the same principles that this does, in March, April, and May, 1861.

Int. 44. State whether or not the apparatus which you have described, and represented in model Exhibit No. 33, was put into operation at Kier's works in the year 1861, and whether successfully or otherwise.

Ans. It was put successfully in operation in that year.

Int. 45. State whether you constructed, or directed the construction of, any other oil-works during the year 1861; and, if so, name them; and state, in the same connection, what, if any, apparatus was put up therein by your direction, for the use of steam or superheated steam in the distillation of petroleum at such works.

Ans. I finished the construction of the Enitesco Works of Messrs. Sellers & Canfield. I put in superheated apparatus and put it in operation. The works were located in the city of Pittsburg, at Boundary street. This was probably in Pitt Township, Alleghany County, at that time. It is in the city now. There were three stills with superheated apparatus. I also designed and constructed the following works: The Eagle Oil-Works of Messrs. Wightman & Anderson, near Lawrenceville; there were three eighty-barrel stills, with superheated furnace, etc.; also the Petroleum Oil-Works of Messrs. Long, Miller & Co., near the Sharpsburg bridge; there were two eighty-barrel stills with superheated furnaces, etc.; also the Brilliant Oil-Works of Messrs. Lockhart, Frew & Co., at Negley's Run; there were two eighty-barrel stills, and two three-hundred-barrel stills or about that capacity, with superheated furnace, etc.; also, the Butcher's Run Oil-Works of Alexander Taylor & Co.; there were two stills with superheated
246 furnace, etc.; also the Saw-mill Run Oil-Works of Messrs. Bell, Petty & Co. at Saw-mill Run; I think there were two stills, and one superheated furnace, etc. I reconstructed a small refinery for Mr. S. M. Kier at Lawrenceville. These refineries were all designed, constructed, and put in operation during the summer and fall of 1861, except that of Lockhart, Frew & Co., which was put in operation, I think, in January, 1862. These works are all situated in Alleghany County, Pennsylvania.

Int. 46. Have you any drawing of the distilling, superheating, and condensing apparatus put up by you, or by your direction, in any of those works, during the year 1861? And, if so, produce the same, and explain it by reference to letters to be marked thereon.

Ans. I have such a drawing, and here produce it, (marked "Respondents' exhibit No. 24, J. H. B.") A represents a still of about eighty

barrels' capacity; B, a goose-neck to carry over vapors to the condensing-pipes C, which are placed in the water-tank D. The oil after passing through the condense-pipes and gas-trap E, are delivered at point F. G is a pipe for the escape of non-condensible gases. H is a superheating furnace, in which is placed a continuous coil of cast-iron pipe. J is a tight coil of wrought-iron pipe, placed in the still A. K is a pipe leading from the superheater, terminating in radial pipes which are perforated with numerous small holes. L is a pipe connected with the bottom of the still for drawing off the residuum. M is a furnace to heat the still. N are flues surrounding the still, which can be used or shut off at pleasure by dampers, which are not shown in the drawing. O is a cock to admit steam to the perforated radial pipes. P is a cock to admit steam to the coil. Q is a cock at the termination of the coil. R is a cock so placed as to prevent condensed water entering by the pipe K. This apparatus was put up at Lockart, Frew & Company's Brillant Oil-Works at Negley's Run, in 1861.

Int. 47. State whether or not the apparatus you have described in Exhibit No. 34 was put in practical operation at Lockhart, Frew & Co.'s works, when, and with what success.

Ans. It was put successfully in operation, I think, in January, 1862, at their works.

Int. 48. State whether or not the apparatus put up in the
247 works you have referred to in your answer to interrogatory 45 was substantially similar to those shown in Exhibit No. 34, and whether or not they were put in successful practical operation.

Ans. The apparatus put up in the works mentioned embodied substantially the same principles as those embodied in Lockhart, Frew & Company's works. They were all put in successful operation during the summer and fall of 1861, except that put up at S. M. Kier's works on Seventh street, and the two first stills put up at Freedom at the works of S. M. Kier, in which the steam was not heated by a superheating furnace, but by coils placed in the interior of the stills, in direct contact with the hot oil, the oil being heated by a furnace underneath the stills.

Int. 49. Do you mean by your last answer that the apparatus at Kier's works did not operate successfully?

Ans. I do not. It operated successfully, but it was put up as a simple and easy mode of effecting the object in view.

Int. 50. Are you the Herbert W. C. Tweddle who is the patentee in the patents Respondents' exhibits Nos. 29, 30, and 31?

Ans. I am.

Int. 51. Did you, in the apparatus you put up at Kier's works, and at Lockhart, Frew & Co.'s, and in the works referred to in your answer to interrogatory 45, use any means of producing within the still, or pipes leading from the still, a vacuum or partial vacuum?

Ans. No.

Int. 52. Had you anything to do with the construction or operation of the Standard Oil-Works in or near Pittsburg? If so, state when they were constructed, and for what purpose.

Ans. I designed the Standard Oil-Works in the spring of 1862, and laid out the works on July 4, 1862. They are in Collins Township, now in the city of Pittsburg. I commenced their construction the next day. They were for the purpose of distilling crude petroleum.

Int. 53. What process of distillation and what description of apparatus did you purpose to carry on and construct in the said works when you commenced their construction?

Ans. I intended to distil by superheated steam in vacuo, and ordered the apparatus to do so.

248 Int. 54. What peculiar apparatus did you order for this purpose?

Ans. I ordered two large vacuum-stills, a vacuum-pump, and all the necessary apparatus.

Int. 55. Did you, at that time, carry into effect your purpose of introducing the process of vacuum distillation in those works?

Ans. I did not.

Int. 56. Why?

Ans. The parties from whom I ordered the vacuum-stills and pump, etc., did not come up to time. We were in a great hurry to get the works in operation, so I altered my plans, and put in similar apparatus, which I had previously introduced in the works which I had constructed before, only on a much larger scale. By making this change in my plans I got the works in operation in October, 1862. If I had carried out my original intention I could not have got the works in operation till the summer of 1863.

Int. 57. Did you use fire under your stills at the Standard Works; and how did you apply the heat in distilling oil?

Ans. I had fire under the stills, and coils of pipe and blow-pipes, to use superheated steam in connection with fire.

Int. 58. How extensive were the Standard Oil-Works?

Ans. At first, in 1862, they covered pretty closely some six or seven acres of ground. In 1866 they covered some eleven or twelve acres. They were the most extensive works in the country for refining petroleum from the time they were built till the fall of 1866. We refined at first about a million and a half of gallons per annum, and in 1866 about four millions of gallons.

Int. 59. Who managed those works?

Ans. I managed them.

Int. 60. Are they still in existence?

Ans. They are.

Int. 61. Are you still connected with those works? If not, when did your connection with them cease?

Ans. I am not. I sold out my interest 29th of October, 1866, but continued the management of them until about 20th of December, 1866.

Int. 62. Did you, at any time during your management of the Standard Works, make any distillation of petroleum in vacuo?

Ans. I did.

249 Int. 63. With what result?

Ans. I obtained results which in a measure induced me to build the Eclipse Petroleum Refinery at the Sharpsburg bridge, Allegany County. I purchased property, between five and six acres, on 1st of September, 1866, on which I built the Eclipse Petroleum Refinery, at the Sharpsburg bridge.

Int. 64. What was the result or results of the distillation in vacuo, which you made prior to your leaving the Standard Works, and which induced you to construct the Eclipe Refinery? I mean by results to refer to the product or products of such vacuum-distillations.

Ans. I produced from crude petroleum by distillation in vacuo, with superheated steam, burning oils, with very little odor, compared with that from fire-distillation, and heavy paraffine-oils with very little odor, both of which were almost devoid of the blue color or fluorescence, and also produced a residuum almost odorless, without tar or coke.

Adjourned till 2½ p. m.

Met pursuant to adjournment at same place at 2½ p. m.

Resumed:

Int. 65. State at what time or times, between the years 1862 and 1866, as near as you can, you produced the effects you have stated in your last answer.

Ans. I produced them repeatedly during 1864, 1865, and 1866.

Int. 66. Have you got any books or memoranda which would enable you to give the dates exactly?

Ans. I have not. My house was destroyed on 25th of September, 1867. My books, papers, plans, memoranda, etc., were all destroyed. I was absent in Cleveland at the time. My dwelling-house was in Collins Township, on the top of the hill, near the Standard Oil-Works.

Int. 67. State whether the product or products you have referred to in your answer to interrogatory 64 were residuums or distillates.

Ans. The burning oil and paraffine oil were distillates. The residuum was what I call it.

Int. 68. What was the character of the heavy paraffine oil pro-
250 duced by you as referred to in your answer to question 64, in regard to color, density, and odor?

Ans. The color was yellow, something like olive-oil; the density between 33 and 35 Beaumé, with very little odor. It was light. It was something like what I now call the neutral topaz oil, which I manufacture.

Int. 69. What was the character of the residuum obtained after procuring the burning oil and heavy paraffine oil, as stated in your answer to the 64th question?

Ans. It was dark greenish brown, almost inodorous, and viscid at ordinary temperatures.

Int. 70. State whether at any time previous to your leaving the Standard Works you produced any oil as a residuum having the characteristics of the heavy paraffine distillate referred to in your 68th answer.

Ans. Yes; I did produce an oil as a residuum almost inodorous. It was a residuum of a second distillation by superheated steam, in a still heated by fire.

Int. 71. State what kind of oil you produced this residuum from, and the process of distillation, together with the results of the process.

Ans. I purchased in the fall of 1864 some two or three hundred barrels of petroleum which had a stinking and offensive odor. It was crude petroleum, and came, I believe, from Barren County, Kentucky, somewhere near the Tennessee line. I think that was the name of the county. No refiners would purchase it on account of its bad odor. I purchased it at a cheap price. In the spring of 1865, I treated this oil in an agitator, with sulphuric acid, precipitating a heavy deposit of carbonaceous matter. I then treated the oil with alkali, etc., and distilled the oil by fire and supersteam. (The crude oil was of very heavy gravity.) The distillate had a very bad odor. I treated it again in an agitator with sulphuric acid and alkali. I redistilled the oil again by fire and superheated steam. When the oil began to run from the condenser very yellow I stopped the distillation. The residuum in the still was amber-colored, with very little odor. The distillate had a bad odor, which was only partially removed by another treatment with acid and alkali.
251 The residuum was substantially the same as the oil produced by the process of J. Merrill, described in letters-patent No. 90284, and the process was substantially the same.

Int. 72. State whether or not you proceeded to construct the Eclipse

Works, and when, and what was the character of the apparatus which you put up therein.

Ans. I commenced to excavate for a crude-oil tank, on my property at the Sharpsburg bridge, about the 20th of December, 1866. The tank was to hold about twenty thousand barrels of crude petroleum. I also ordered a vacuum-pan, a double vacuum-engine, condenser, and all the other apparatus for a large refinery. I built a two-story warehouse, about a hundred feet square, machine-shop, and a lot of other apparatus. I got the vacuum-pan finished in May, 1867.

Int. 73. What was the character of the process of distillation which you proposed to carry on at those works?

Ans. It was to distil crude petroleum in vacuo, by superheated steam.

Int. 74. State whether or not your stills for distilling by superheated steam were also heated with fire.

Ans. I only put up one vacuum-still at first. It was set in brick-work and heated by superheated steam, without fire.

Int. 75. Have you any model representing the still you refer to, which you first put up at the Eclipse Works?

Ans. I have a model, not an exact representation, but which can be made to represent the still I first put up at the Eclipse Works.

Int. 76. Produce the model and explain in what respects it differs from the still you first put up at the Eclipse Works.

Ans. It is the model marked "Respondents' Exhibit No. 33," already in evidence. The steam-pipes in the interior of the still were arranged horizontally, instead of being arranged in a coil. The steam-pipes were constructed and arranged in the manner shown in the model, respondents' Exhibit, No. 35, J. H. B. The end of the condenser was attached to a vacuum-pump for producing a vacuum in the still and pumping away the condensed distillate. There was no furnace under the still, as is represented in model, Exhibit No. 33.

Int. 77. State whether or not you put this apparatus in operation at the Eclipse Works.

252 Ans. I put it in operation about the latter end of May or early in June, 1867.

Int. 78. What did you propose manufacturing at these works?

Ans. Burning oils, lubricating oils, and paraffine.

Int. 79. What was the character of the burning oils you made at these works at this time?

Ans. It was white, high fire-test, and totally devoid of the fluorescence, or blue color, that characterizes the burning oils distilled by the ordinary fire-process, and had not the objectionable odor which characterizes ordinary fire-distilled burning oils. I sold it without further purification.

Int. 80. Do you mean to say that you sold the burning oil distillate, such as you have desribed, without further purification or treatment with acids and alkalies?

Ans. I do.

Int. 81. To what do you attribute the absence in the distillate produced by your process of manufacture of the offensive odor peculiar to fire-distilled oils?

Ans. Crude petroleum distils at a lower temperature in vacuo than under atmospheric pressure. Owing to the lower temperature the oil is not decomposed, and the bad odors which characterize the distillates of fire-distillation are not generated where crude oil is distilled in vacuo by superheated steam. Crude petroleum contains more or less sulphur.

Whenever you decompose hydrocarbons at a high temperature in the presence of sulphur, bad odors are generated.

Int. 82. State whether the bad odors you have referred to exist either in the distillate or in the residuum, in the process of distilling burning oils and heavy paraffine oils, by the process and with the apparatus constructed and used by you when you first put in operation your Eclipse Works, as you have stated.

Ans. They exist in neither. The residuum is nearly odorless. The burning oil has an odor, but which is not objectionable.

Int. 83. State whether the disagreeable odor of the distillate of fire-distilled oils is the same as or different from the peculiar odor of crude petroleum.

Ans. It is not the same odor as crude petroleum, but is much
253 more offensive, particularly of the oils which are distilled over towards the latter stages of the distillation by fire.

Int. 84. State whether this peculiarly offensive odor is produced in any part of the operation of distilling burning-oils and heavy paraffine or lubricating oils, as practised by you at your Eclipse Works when you first started your works.

Ans. It is not.

Int. 85. Can you produce samples of the products of distillation of crude petroleum by fire-heat as ordinarily practised at the several stages of the operation? If so, please do so and have them marked as exhibits, showing both the residuums and distillates.

Ans. I produce the following samples: Respondents' Exhibit No. 36, J. H. B., is crude naphtha 72 Beaumé. No. 37, J. H. B., is first of light distillate, gravity 60 Beaumé. No. 38, J. H. B., is last of distillate, gravity 39 Beaumé. No. 39, J. H. B., is last portion of distillate, 36 Beaumé, showing decomposed oil. No. 40, J. H. B., is last portion of distillate, 48 Beaumé, showing decomposed oil. No. 41, J. H. B., is average of the whole distillate, when mixed together, 46 Beaumé. No. 42, J. H. B., is refined petroleum burning-oil, 45 Beaumé. No. 43, J. H. B., is tar, residuum of distillation. Beside the tar, we get some coke in the bottom of the stills. A considerable quantity of non-condensable gases escape from the gas-traps and are usually discharged into the air.

Int. 86. What is the tar you refer to and to what purposes is it put?

Ans. This tar is black fluid, and contains more or less coke. It has a bad odor. It is used by the paraffine-oil manufacturers to manufacture paraffine oils and paraffine from. Sometimes it is decomposed and burning-oils manufactured from it.

Int. 87. What is the oil which is called the heavy hydrocarbon oil of commerce?

Ans. That is it which I produce, and it is marked "Respondents' Exhibit No. 44, J. H. B." This is the average sample of distillation from tar, gravity 28 Beaumé. It is a distillate of tar by fire-distillation.

Int. 88. Describe the ordinary process of the distillation of tar for the production of paraffine oils and produce samples as exhibits.

Ans. The tar is placed in a still heated by fire, and heated until this oil distils off, which I call the first distillate of tar. It is marked
254 "Respondents' Exhibit No. 4, J. H. B." This sample is some of the distillate. It is 32 to 33 gravity. It is produced by the increased application of heat. It is marked "Respondents' Exhibit No. 46, J. H. B." The heat is still further increased, and towards the latter end of the run this runs from the condenser. It is rich in paraffine and is from 25½ to 26 gravity. It is marked "Respondents' Exhibit No. 47, J. H. B." The heat is still further increased when this yellow viscid oil runs from

the condenser. It is marked "Respondents' Exhibit No. 48, J. H. B." A further increase of heat—a red heat at the bottom of the oil—runs over this yellow waxy substance. It is marked "Respondents' Exhibit No. 49, J. H. B." Coke remains in the still. This is a sample. It is marked "Respondents' Exhibit No. 50, J. H. B." The oils that run from the still between and including the oils such as Exhibits Nos. 46 and 47, when mixed, make the heavy hydrocarbon oil Exhibit No. 44. This average sample of distillate No. 44 may be lighter or darker in color, according to the mode of distillation, but this I consider a fair sample.

Int. 89. State what further treatment tar-distillate is subjected to in the ordinary process of fire-distillation for the production of solid paraffine and lubricating oil.

Ans. It is chilled and pressed. The expressed oil is then subjected to chemical treatment and clarified. It is then the paraffine oil of commerce, such as respondents' exhibit No. 51, J. H. B. This is a sample of a low grade. The paraffine itself requires further purification. This is a sample of the paraffine pressed from Exhibit 44. This is unrefined paraffine. Sometimes the distillate, Exhibit 44, is purified by acids and alkalies previous to being chilled and pressed. When such mode of procedure is pursued, this is a sample of the paraffine produced. It is marked "Exhibit No. 53, J. H. B." The expressed oil will be the paraffine oil of commerce.

Adjourned till to-morrow at 10 a. m.

255 FEBRUARY 28, 1871.

Met at time and place of adjournment.

Resumed:

Int. 90. What is fractional distillation?

Ans. It is dividing the products of distillation of crude petroleum into products having different gravities and boiling-points; for instance, of crude petroleum, the fractional distillation is classified thus: first, rhigolene, which is exceedingly volatile with a low boiling-point; second, gasoline, eighty to eighty-four Beaumé; third, naphtha, from sixty to eighty in gravity; burning-oils, from thirty-eight to sixty Beaumé; heavy lubricating oils containing paraffine, from twenty-five to thirty-eight Beaumé.

Int. 91. In the ordinary process of fire-distillation under atmospheric pressure, as practised prior to the year 1867, was it customary to practise fractional distillation, as you have stated in your last answer?

Ans. It was.

Int. 92. What were the characteristics of the heavy lubricating oil, containing paraffine, obtained from the last run of fractional distillation, as stated in your 90th answer?

Ans. They were dark yellow-green in color, with a heavy blue tint, and possessed a bad, offensive color.

Int. 93. For what purpose was that product sold and used?

Ans. It was sold sometimes to the paraffine-oil manufacturers. Many petroleum-refiners practise the redistillation of the heavy oils, decomposing the paraffine and producing light burning-oils.

Int. 94. Are you the manufacturer of the article known in the trade as neutral topaz oil, such as is sold under that name by the respondents in this case?

Ans. I am the manufacturer of neutral topaz oil, and my oil has been sold to Yeomans & Goss, of Boston, Massachusetts.

Int. 95. How does this neutral topaz oil, as manufactured by you be

fore the paraffine is expressed, differ from the heavy lubricating oil referred to in your answer to the 92d interrogatory?

Ans. The paraffine oil or netural topaz oil which I manufacture is light yellow in color and has very little odor, and is a good lubricator,
256 of a gravity from thirty-three to thirty-five Beaumé. The heavy lubricating oil which I speak of in my answer to the 92d interrogatory is dark yellow-green in color, has an extremely offensive odor, and a gravity varying from twenty-five to thirty-eight Beaumé. I am not sure about what the average would be. It varies according to the different crude petroleums from which it is produced.

Int. 96. Prior to the year 1867, what was the mode practised of expressing the paraffine from the heavy hydrocarbon oils?

Ans. The heavy hydrocarbon oil shown in Exhibit 44, J. H. B., was frozen naturally or artificially; put in bags or cloths or centrifugals and submitted to pressure. The paraffine oil exudes and the paraffine-wax remains in the cloths or bags, etc.

Int. 97. Do you mean that the distillate referred to in your answer to question 92 was the same as Exhibit 44, J. H. B.?

Ans. I do not mean that they were the same, but they have the same general characteristics, namely, offensive odor, dark color, heavy blue tint; but that which I mention in my answer to interrogatory 92 would be lighter in gravity than that sample, Exhibit 44, J. H. B., which is distilled from tar.

Int. 98. About what temperature do you ordinarily use in the process of distillation, by steam, superheated steam, and vacuum, in the production of burning-oils and your neutral topaz oil from crude petroleum?

Ans. I cannot give you the exact figures. I lost all my memoranda on the subject when my late residence and refinery were destroyed by fire last year. The burning-oil, however, comes over at a very low temperature; the latter end of the paraffine oils, I should say, about four hundred and fifty degrees. The paraffine oils require a higher temperature than the burning-oils.

Int. 99. State what effect on the degree of temperature which you are enabled to use in the distillation of petroleum the use of steam and a vacuum has, as compared with the use of fire-heat under atmospheric pressure. By the term atmospheric pressure, I mean the absence of the use of an artificial vacuum.

Ans. By the use of superheated steam in a vacuum, I do not reach such high temperatures as are reached in distilling petroleum by fire under atmospheric pressure; nor do I decompose the oils, pre-
257 cipitating coke and tar, nor do I generate offensive oils, to be carried over with the distillate. When you distil under atmospheric pressure, you reach temperatures six hundred and fifty Fahrenheit, to a low red heat on the bottom of the still, and precipitate tar and coke.

Int. 100. What effect has the use of steam, superheated steam, and vacuum on the yield of paraffine from petroleum, as compared with the use of fire-distillation under atmospheric pressure?

Ans. By the use of superheated steam in vacuo, in distilling crude petroleum, the yield of paraffine is very much increased. When you distil petroleum under atmospheric pressure by the fire-distillation in ordinary use or by fire and superheated steam under atmospheric pressure, a large portion of the paraffine is decomposed into light burning oils and coke.

Int. 101. In the manufacture of your neutral topaz oil, what yield of paraffine do you obtain?

Ans. I have obtained twelve pounds per barrel of crude petroleum of refined paraffine-wax.

Int. 102. In fire-distillation of crude petroleum, with or without steam, what was the result in amount of the production of coke? State your own experience.

Ans. In 1866 I distilled, say, one hundred thousand barrels of crude petroleum and produced about eight thousand barrels of tar. This produced, when distilled, about two thousand barrels of coke. I distilled this tar by fire-heat, partially by steam at the Standard Refinery in 1866.

Int. 103. What was the result, as to the production of tar and coke, in the use of your apparatus, as put into operation by you in the Eclipse Works in 1867, in the use of steam, superheated steam, and vacuum?

Ans. I have distilled fifty or sixty thousand barrels of crude petroleum by superheated steam in vacuo, and have never produced any tar or coke. I have never had occasion to clean out my vacuum-stills, which is an operation necessary after every distilling operation by the ordinary fire-process in use, because the coke precipitated burns on or adheres to the bottom of the still and prevents the transmission of heat. If it were not removed after each operation, the bottom of the still would soon be destroyed.

258 Int. 104. You have stated that you distilled burning oils from petroleum with superheated steam in vacuo by the use of the first apparatus which you put up at the Eclipse Works. State whether or not you also obtained heavy paraffine or lubricating oil as a distillate?

Ans. I did, as a distillate, produce paraffine oil, or neutral topaz oil, the same as I now do.

Int. 105. When was it that you did this?

Ans. In June, July, August, and September, 1867.

Int. 106. State whether or not you expressed the paraffine from this oil referred to in your last answer?

Ans. I did, and made neutral topaz oil at that time.

Int. 107. Will you please produce a specimen of your neutral topaz oil, to be marked as an exhibit in this case?

Ans. I here produce it, (marked "Respondents' Exhibit No. 54, J. H. B.")

Int. 108. State whether or not the neutral topaz oil, Exhibit 54, J. H. B., is in the condition in which it runs from the condenser as a distillate.

Ans. It is not.

Int. 109. Can you produce a specimen of your neutral topaz oil as it runs from the still as a distillate?

Ans. This is it. (Marked "Respondents' Exhibit No. 55, J. H. B.")

Int. 110. How does the neutral topaz oil, Exhibit 54, differ from the oil Exhibit 55, J. H. B.?

Ans. The paraffine oil, No. 55, has been subjected to a slight chemical treatment, to produce the neutral topaz oil, Exhibit No. 54, J. H. B., and has had the paraffine expressed from it.

Int. 111. State whether the Exhibits No. 54 and 55 are the products of one or of more distillations.

Ans. Of one distillation.

Int. 112. You have stated that, as the result or results of distillation in vacuo, which you made prior to your leaving the Standard Oil Works, you produced burning oils with very little odor and heavy paraffine oils with very little odor, both of which were almost devoid of the blue

color or fluorescence; and in answer to question 68, in reference to the same heavy paraffine oil, you stated that the color was yellow, something like olive oil, of a density between thirty-three and thirty-
259 five Beaumé, with very little odor; that it was something like what you now call your neutral topaz oil. State how it differed, if at all, from either of the Exhibits Nos. 54 and 55, J. H. B.

Ans. It was the same oil as Exhibit No. 55, and only differed from Exhibit No. 54 in having a little more odor. It had not been chemically treated.

Int. 113. State whether or not it had had the paraffine expressed from it.

Ans. It had not.

Int. 114. State how the oil which you call neutral topaz oil, Exhibit No. 54, is manufactured by you.

Ans. I introduce crude petroleum, which has been deprived of naphtha, into a vacuum-still heated by superheated steam, with or without auxiliary fire. I distil over the burning oil first with superheated steam. I then continue the distillation until the gravity of the distillate is thirty-eight Beaumé. I then run the distillate into another tank, until the paraffine is distilled over. Sometimes I stop the distillation before the paraffine is all distilled over. I then freeze this distillate naturally or artificially in barrels; I place the frozen distillate in bags or cloths and express out the oil, which I call raw topaz oil, such as this. (Marked "Respondents' Exhibit No. 56, J. H. B.") This raw topaz oil I then subject to slight chemical treatment. The result is neutral topaz oil. This chemical treatment is not essentially necessary to produce neutral topaz oil. Simple exposure to the sun for a short time accomplishes about the same result. I have sold hundreds, I may say thousands, of barrels of neutral topaz oil so produced.

Adjourned till to-morrow at 9½ o'clock a. m.

MARCH 1, 1871.

Met at time and place of adjournment.

Direct resumed:

Int. 115. You have stated in your last answer the mode in which you manufacture your neutral topaz oil and have exhibited specimens of the oil. Please exhibit now specimens of the expressed paraffine, of the refined paraffine, and of the residuum of your process of distillation as exhibits in this case.

260 Ans. I herewith exhibit a sample of the expressed paraffine, (marked "Respondents' Exhibit No. 57, J. H. B.,") of the refined paraffine, (marked "Respondents' Exhibit No. 58, J. H. B.,") and of the residuum left in still after the paraffine oils have been distilled over, (marked "Respondents' Exhibit No. 59, J. H. B.")

Int. 116. What is the character of the residuum No. 59?

Ans. It is dark greenish-brown in color, viscid in body, with hardly any perceptible odor; it is twenty-five to twenty-six degrees Beaumé in gravity.

Int. 117. To what uses, if any, is it applied?

Ans. It is a first-rate lubricating oil.

Int. 118. Can you exhibit a sample of the burning oil produced by your process, as stated in your answer to question 114?

Ans. I here produce it. (Marked "Respondents' Exhibit No. 60, J. H. B.")

Int. 119. You have stated in your answer to question 114 that you

subject your raw topaz oil to slight chemical treatment to produce your neutral topaz oil, but that this treatment is not essentially necessary, but that simple exposure to the sun produces about the same result. State whether or not you have sold or are in the habit of selling your neutral topaz oil, which has been exposed to the sun, without the chemical treatment spoken of.

Ans. I have sold and am in the habit of selling neutral topaz oil which has not been chemically treated, either before the paraffine is expressed from it or after the paraffine has been expressed from it, but have sold hundreds, I may say thousands, of barrels of neutral topaz oil, which has been simply heated by steam and exposed to the sun in shallow tanks.

Int. 120. What difference, if any, is there in your neutral topaz oil exposed to sun-treatment, as you have described, and that subjected to chemical treatment, and do you or not make any distinction between those oils in the trade?

Ans. The oil which I subject to chemical treatment may have a little less odor than that which has been exposed to the sun, but I make no distinction to the trade in selling them.

Int. 121. Do you know which of these oils you have furnished to the respondents in this case?

261 Ans. I can't tell. I have shipped both kinds in large quantities to both New York and Boston. In the winter and spring I ship neutral topaz oil treated chemically; in summer I usually omit the chemical treatment.

Int. 122. Do you consider your neutral topaz oil odorless?

Ans. I do not, or never did.

Int. 123. What effect, if any, has an overexposure of your neutral topaz oil to the sun?

Ans. By being too long exposed to the sun, it contracts an odor which is slightly pungent.

Int. 124. How does the process which you employed from June to September, 1867, and by which you produced your neutral topaz oil, differ from the ordinary process of fire-distillation under atmospheric pressure?

Ans. I introduced crude petroleum which had been deprived of naphtha into a vacuum-still, and, with the aid of superheated steam, distilled off burning-oils and heavy paraffine oils with very little odor, leaving in the still a residuum which contained neither tar nor coke. In distilling crude petroleum by the ordinary fire-process in use, you introduce the crude petroleum, usually in its natural state, (though it may previously have been deprived of its naphtha.) A fire is lighted underneath the still; first the naphthas are distilled over, (provided the crude petroleum has not previously been deprived of it;) then the burning-oils, down to about thirty-eight gravity. It is usual, at this period, to slack the fires and carry on the distillation with less fire, more slowly, for the purpose of decomposing the paraffine and producing light burning-oils. All the oils produced have a bad offensive odor. Tar and coke and a substance resembling asphaltum remain in the still. This is a sample of the residuum. (Marked "Respondents' exhibit No. 61, J. H. B.") In the fire-distillation, under atmospheric pressure, very high temperatures, being upwards, at the latter end, of six hundred Fahrenheit, whilst in my process, per vacuum and superheated steam, low temperatures are used. I may mention that when the heavy oils, about thirty-eight gravity, are running at the latter end of the fire-distillation, by the introduction of steam or superheated steam through perforated

pipes into the body of the oil being distilled, the distillation is carried on more rapidly. The paraffine is not decomposed so much, and
262 heavy hydrocarbon oils distil over, instead of light burning-oils, which come over when the paraffine is decomposed by a slower distillation by fire-heat alone. All of these oils have offensive odors, and tar and coke are left in the still as a residuum.

Int. 125. State now the characteristic difference between the mode of distillation practised by you between June and September, 1867, by which you produced your neutral topaz oil, and the process of distillation by fire under atmospheric pressure, which produces the difference in results stated in your last answer.

Ans. I used a vacuum-still and distilled by the aid of superheated steam in vacuo at low temperatures. In the other case the distillation is carried on by a naked fire under the still, under atmospheric pressure, and high temperatures are used.

Int. 126. When you have stated the gravities, Beaumé, during this examination, at what temperature is the gravity taken?

Ans. About sixty Fahrenheit.

Int. 127. What degree of vacuum do you employ in the manufacture of your nautral topaz oil, expressed in inches?

Ans. I employ a vacuum of from twenty-seven to thirty inches, and keep it as high as I can possibly get it. The higher the vacuum the better I can carry on the process.

Int. 128. You have described the apparatus which you first put up at the Eclipse Works and with which you made your neutral topaz oil. State whether you made any alterations or enlargement of your apparatus, and what they were.

Ans. In the fall and winter of 1867–'68, I enlarged my works very much. I added two large vacuum-pans to increase my distilling capacity and a good deal of other apparatus. I expended some thirty or forty thousand dollars in improvements.

Int. 129. Have you a model exhibiting the apparatus which you put into your Eclipse Works at the time you have just stated?

Ans. I have, and here produce it. It is the model I before referred *it*, and marked "Respondents' exhibit No. 35, J. H. B."

Int. 130. Please describe the model and its operation.

Ans. The still "A" is a vacuum-still, connected with a condenser, "B." "C" is a vacuum-still, connected with a condenser, "D." "E" repre-
263 sents a pump for producing a vacuum. "F" represents a vacuum-chamber for receiving the residuum. The still "A" contains steam-pipes for dry steam and troughs perforated and serrated underneath, and perforated blow-pipes placed under the horizontal steam-pipes, with a distributor over the troughs, the same as the vacuum-still "C." The crude petroleum, deprived of its naphtha, is admitted into the still by the cock "G," which regulates its flow, a vacuum being produced in the still "A" and condenser "B," which is connected with the vacuum-pump. A vacuum is also produced in the still "C" and the condenser "D" by means of a vacuum-pump. Steam is admitted into the steam-pipes in "A." Steam or superheated steam is admitted into the pipes in the still "C." Superheated steam is admitted into the perforated pipes in "A." Superheated steam is admitted into the perforated pipes in the still "C." The crude oil is sucked into the still by the cock "G," and is distributed by the distributor and the troughs over the steam-pipes in the still by the serrated edges underneath the troughs. As the crude oil flows over the pipes in still "A," the light oils and burning-oils are distilled over and condensed in the condenser. Cold water surrounds

the pipes in both condensers. Both condensers have injecting-cocks to inject cold water, to assist, if necessary, in condensing the oil-vapors. When the oil is deprived of the light oils, down to about thirty-eight gravity in the still "A," oil flows from the bottom of still "A" into the distributor placed above the troughs in the still "C." There are holes in the distributor over the troughs for the discharge of the oil not shown in the model. On the pipe which connects the bottom of still "A" with the distributor in the still "C," there is a cock placed to stop or regulate the flow. The oil is then distributed by the troughs with serrated edges over the steam-pipes in still "C," and the vapors flow into the condenser "D," and are condensed, and are pumped by a vacuum-pump to a tank. In the still "C," I distil over the paraffine oil, until the paraffine is nearly or wholly distilled over. A vacuum being produced in the chamber "F," the residuum in still "C" is drawn by an appropriate pipe into the receiver "F," the vacuum at the same time being lowered in the still "C." There are gauges attached to both stills, which are not shown in the model. By means of these gauges the height of the oil in the still, its quality, its gravity, etc., can be examined when required. Each still has a separate pump. Steam or superheated steam can be used
264 in all the pipes at pleasure. Both stills can be used simultaneously to produce burning-oils. Both stills can be used to produce paraffine oils, simultaneously at the pleasure of the operator. The condensers shown in the model differ from the condensers built at the Eclipse Refinery, but attain substantially the same result. The pump shown in the model is a single double-acting pump; at my works I had two double-acting pumps which could be used separately or singly. I left the still "C" and condenser "D" open in the model to show, as nearly as possible, how my stills were constructed. The condensers differ from those put up at my Eclipse Works at Sharpsburg bridge in the following-described particulars: In the model the vapors are shown as being condensed on the exterior of the pipes; cold water running through the pipes; the pipes being perpendicular. At my works the vapors were condensed in the interior of a series of pipes placed horizontally in a tank of cold water.

Int. 131. Is the apparatus, as you have described it and which you put up at the Eclipse Works in 1867–'8, the same as or similar to that which you still use for the manufacture of your burning-oil and neutral topaz oil?

Ans. It is similar to that I now use.

Int. 132. How many such stills or apparatus did you have in use at your Eclipse Works at the Sharpsburg bridge?

Ans. Two like the last model, No. 35, and one like the model Exhibit No. 33, with the modification specified.

Int. 133. Are those works still in existence?

Ans. They are not. A crude-oil tank, containing some fifteen or sixteen thousand barrels of crude petroleum, was struck by lightning and torn to pieces, igniting the oil, which carried away and destroyed my entire works and residence, also destroying a number of other refineries and the Sharpsburg bridge. This occurred on 28th day of June, 1870. It destroyed about eight hundred thousand dollars, of which my works represented three hundred and fifty thousand dollars.

Int. 134. State whether the apparatus at the Eclipse Works, similar to Exhibit No. 35, was used by you for the manufacture of your neutral topaz oil?

Ans. It was.

Int. 135. State how the neutral topaz oil, manufactured by that

265 apparatus, corresponded with that manufactured by the first apparatus you put up at the Eclipse Works.

Ans. It made exactly the same oil.

Int. 136. About what time was the apparatus similar to Exhibit No. 35 put in operation at the Eclipse Works at the Sharpsburg bridge?

Ans. About May, 1868.

Int. 137. After making the neutral topaz oil, between June and September, 1867, at the Eclipse Works, did you or not make any effort to interest any other party with you, or to get up a company to manufacture that and your other oils? If so, state when, and with what result.

Ans. In September, 1867, I tried to organize a company to assist me in enlarging and carrying on the refining operations at my works. I went to New York in the latter part of September, 1867, with that object in view. I had previously had several communications with Mr. L. L. Lombard, of New York, on the subject. I was very much embarrassed financially at the time; my works having cost me a great deal more money than I had anticipated. Mr. L. L. Lombard commenced to try and enlist some of his friends in the enterprise. His prospects of success were such that I came back to Pittsburg, about the 20th of September, 1867, and went to Cleveland. My house near the Standard Works was burned during my absence in Cleveland. I returned to Pittsburg, and in October, the early part, I think, I ordered the two vacuum pans or stills, etc., Exhibit No. 35, and other apparatus. I devoted my entire attention to the enlargement of my works, during that fall and winter. In the latter part of December, Mr. Lombard was nearly killed in the Angola disaster, near Buffalo, and the embryo organization of the company fell through.

Int. 138. State whether, in that connection, you exhibited any samples or specimens of the products of your works to Mr. Lombard; when, and what they were.

Ans. About September, the 16th or 17th, 1867, I went to New York with my family, and took with me samples of my products: burning oil, neutral topaz oil, residuum, and refined paraffine. I gave them to Mr. Lombard and returned to Pittsburg on the 20th or 21st of the same month. I went to Cleveland on 23d of September.

Adjourned till to-morrow at 9½ a. m.

266 MARCH 2, 1871.

Met at time and place according to adjournment.

Resumed:

Int. 139. How were these specimens put up?

Ans. They were in bottles, placed in a box, which I had used for holding photographic negatives.

Int. 140. You stated, in answer to question 138, that among the samples you gave to Mr. Lombard in September, 1867, was some of your neutral topaz oil; did you give that product that name at that time?

Ans. I did not. I think I called it spindle oil.

Int. 141. State whether that specimen, which you think you called spindle oil, was the same or a different oil from that you now make and sell as neutral topaz oil?

Ans. It was the same oil that I now make and sell as neutral topaz oil.

Int. 142. You have stated, in your answer to question 130, that in the apparatus similar to Exhibit No. 35, which you erected at your Eclipse

Works, at the Sharpsburg bridge, both your vacuum-stills could be used simultaneously to produce burning oils, and both simultaneously to produce paraffine oils; now, if you were using them simultaneously to produce burning oils, how would you prevent the production of paraffine oils; and what do you mean by paraffine oils, in that connection?

Ans. I charge the stills simultaneously with crude petroleum which has been deprived of naphtha. I distil off by steam, and superheated steam, the burning oils. Whenever the burning oils reach a gravity of about thirty-eight, we pump the distillate, which is now paraffine oil, into a separate tank, and continue the distillation into that tank, until the paraffine or neutral topaz oil is distilled over. This I call using the stills simultaneously, for the production of burning oils, and neutral topaz oils, or paraffine oils. I mean by paraffine oils, the oil from which I express paraffine, to make raw topaz oil, which, by treating chemically, or by exposure to the sun, I then call the product neutral topaz oil. By pursuing my process of distillation by superheated steam in vacuo, I can't produce anything else but neutral topaz oil, and burning oil. I don't mean that we distil over the burning oil and the paraffine
267 oil at the same time; the burning oil is distilled and pumped first into one tank, and then the paraffine oils are distilled and pumped into a separate tank.

Int. 143. To what do you attribute the fluorescence or blue tint, which is visible in many petroleum distillates?

Ans. I attribute it to molecular change in the construction of the oil, caused by the high temperatures, which are used in fire distillation. By distillation in vacuo by superheated steam, the temperatures, being kept as low as possible during the distillation, the decomposition, which causes this fluorescence, does not take place to any great extent.

Int. 144. Are you acquainted with an odor which some petroleum distillates have, and which is called still-smell; if so, state from your experience as an oil refiner to what you believe it to be attributable?

Ans. It is attributable to the decomposition of the oil by high temperatures, forming light, volatile oils, of a pungent offensive odor.

Int. 145. State whether or not you have at any time manufactured, from crude petroleum, a residuum oil, other than that which you have referred to as the residuum of the manufacture of your neutral topaz oil; if so, state when and what were the characteristics of the residuum first referred to in this question.

Ans. In 1867, 1868, and 1869, I purchased some thousands of barrels of Smith's Ferry oil, which has a strong odor. After distilling off the naphthas under atmospheric pressure, I distilled from the oil in vacuo, with superheated steam, most of the burning oil; sometimes all of it. The residuum, remaining in the still, was odorless, or nearly so; was a good lubricator, but chilled easily, because it still contained the paraffine. I sold this oil as amber oil. I herewith produce a specimen of the crude Smith's Ferry oil, and a specimen of the residuum. The crude oil is marked "Respondents' Exhibit No. 62, J. H. B.," and the residuum is marked "Respondents' Exhibit No. 63, J. H. B."

Int. 146. How early in the year 1867 did you do this?

Ans. It was prior to September; some time in the summer.

Int. 147. You say that you sold this oil as amber oil; do you mean that you gave it that name or that it was previously known by that name, or what do you mean?

Ans. I think it was previously known by that name. Other manufacturers had made it by steam and fire.

268 Int. 148. You have referred, in your testimony, to the letters-

patent No. 90284, granted to Joshua Merrill, May 18, 1869; state whether you have examined that patent, and briefly describe the process set forth therein for manufacturing deodorized heavy hydrocarbon oil.

Ans. I have examined the patent of Joshua Merrill, No. 90284, and thus briefly describe his process: First, he takes the heavy hydrocarbon oils, which are distilled from tar, petroleum, etc., which have an offensive odor, peculiar to these oils. Second, he treats them with sulphuric acid and alkalis or chemicals, to remove the offensive odors which have been produced by high temperatures, or he omits this process at pleasure. Third, he distils off by steam or superheated steam and fire from ten to thirty per cent. of the contents of the still to get rid of the offensive odors which were previously generated by the use of high temperatures. The residuum of the oil in the still, after this process, is Joshua Merrill's oil, and is a residuum.

Int. 149. At what stage, if at all, does Merrill propose to remove the paraffine from the heavy hydrocarbon oil?

Ans. Before he puts it in the still to distil off the ten or thirty per cent. of oils which contain the offensive and disgusting odor mentioned.

Int. 150. State whether or not Merrill speaks of producing, by his process, deodorized heavy hydrocarbon oil from crude petroleum, or whether he confines it to the production of such deodorized oil from a distillate?

Ans. He does not speak of producing his oil from crude petroleum, but confines himself to its production from a distillate.

Int. 151. S. Dana Hayes, one of the expert witnesses for the complainant, says in answer to cross-interrogatory fifteen, "The material which Merrill operates upon is one that has been distilled. I consider that Merrill's description involves the previous separation of tarry matters and separated carbon." State whether or not this statement corresponds with your understanding of Merrill's process, as described in his patent.

Ans. It does.

Int. 152. What do you understand to be the meaning of the paragraph, near the close of Merrill's specification, immediately preceding the claim, and commencing with the words "it will also be evident," taken in connection with the rest of the specification?

269 Ans. I understand him to mean that he takes or can take the distillate of crude petroleum, where the light burning oils, the naphthas, and heavy oils have all been distilled over, and are mixed together. He takes this distillate and distils over the naphtha and the burning oil; the residuum in the still he then subjects to the distillation by steam or superheated steam and fire, distilling off the offensive oils, until he is satisfied, I suppose, that the residuum remaining in the still is what he requires.

Int. 153. State in what respects the process described by Merrill in his patent differs from the process by which you produce your neutral topaz oil?

Ans. I take crude petroleum and distil it by steam and superheated steam in vacuo. I first distil off the burning oil; second, I distil over the paraffine oil which I call neutral topaz oil, after it has been subjected to chemical treatment or exposure to the sun and air. My neutral topaz oil is a distillate. I do not generate in my process bad odors.

Int. 154. Does Merrill speak, in his patent referred to, of the use of a

vacuum in connection with steam or superheated steam in carrying out his process?

Ans. He does not.

Int. 155. The complainant, Merrill, in his testimony in answer to interrogatory 13, says, "Since my discovery I know I can manufacture a heavy hydrocarbon oil as free from odor and taste as paraffine wax itself, and paraffine is as odorless as granite." State whether you ever saw any heavy hydrocarbon oil as free from odor as stated by Mr. Merrill?

Ans. I never did.

Int. 156. Then I understand you to say that your neutral topaz oil has never been made by you free from odor—is this so?

Ans. Never.

Int. 157. Have you seen and tested, as to odor, any of Merrill's deodorized heavy hydrocarbon oil, or what you have reason to believe to be such?

Ans. I have examined oil purchased from the Downer Kerosene Oil Company, which they stated to be Merrill's deodorized hydrocarbon oil.

270 Int. 158. Can you produce a sample of such oil and state how you procured it?

Ans. I can, and here produce two samples, purchased from Downer Company, January 16 and 17, 1871. I procured them through J. R. Bartlett, of Boston. One is marked "Spindle oil," twenty-nine degrees Beaumé; the other is marked "Machinery oil," gravity twenty-nine Beaumé. The first is also marked "Respondents' Exhibit No. 64, J. H. B.," and the other is also marked "Respondents' Exhibit No. 65, J. H. B."

Int. 159. When you state the gravity of the oils in those samples, I understand you to refer to the cards attached to the cans; am I right in this supposition?

Ans. You are.

Int. 160. State what marks on these cans you understand refer to the gravity, distinguishing the two exhibits.

Ans. That on Exhibit No. 64, "L 29°, spindle oil." That on Exhibit No. 65, "M 29°, machinery oil."

Int. 161. State whether, after the destruction of the Eclipse refinery at the Sharpsburg bridge, you rebuilt or 'constructed those works, and who was the proprietor of them at the time of their destruction.

Ans. I did not reconstruct those works, nor have they been reconstructed. I alone was the proprietor of them at the time of their destruction.

Int. 162. State where your works are now situate, and when they were constructed.

Ans. My works constitute the borough of Aladdin, in Armstrong County, Pennsylvania, about thirty miles from Pittsburg. They were built to distil oil from shale previous to 1860. They were reconstructed in 1868. I call them now the Eclipse Oil-Works. The photographs I produce are views of the same. They are marked "Respondents' Exhibit Nos. "

Int. 163. State whether those works are those at which you now manufacture your neutral topaz oil; when you commenced manufacturing there; and whether or not the apparatus or process which you employ there for that purpose is substantially the same, or different from that which you have already described as employed for that purpose at your Eclipse Works at the Sharpsburg bridge.

Ans. I commenced to manufacture about August 20, 1870, at
271 those works. The apparatus and process which I use there is substantially the same as used at my old works at the Sharpsburg bridge.

Int. 164. What proportion of neutral topaz oil do you produce from a given quantity of crude petroleum, by your process?

Ans. From twenty-eight to forty-five per cent; it depends upon the kind of crude petroleum used. They vary much.

Int. 165. State whether or not you employ at your works any apparatus or device by which to ascertain the character of the contents of the still, at any stage of the process of distillation; and whether or not such device is in common use in petroleum distilleries; and what is the custom of petroleum refiners as to testing the quality of the contents of the still, by means thereof.

Ans. I have always used, since 1861, a gauge placed on the outside of petroleum stills, and attached thereto, by means of which you can at any time examine the contents of the still, while the operation is going on. I have and now use such device. All good first-class refineries, that I know of, use such device. Since I have been connected with the distillation of petroleum, early in 1861, it has been the habit of distillers to examine the contents of their still at the various stages of distillation.

Int. 166. Can you produce a drawing representing such a device?

Ans. I can, and herewith produce a drawing of the same, marked "Respondents' Exhibit No. 69, J. H. B."

Int. 167. If such a device, or one answering the same purpose, had been in use at the oil-works at which Merrill made his discovery November, 1867, would or would not the fact which he then discovered have been likely to be known to parties distilling the No. 2 oil which he speaks of in the manner described by him, in your opinion?

Ans. If Joshua Merrill had been in the habit of using gauges on his stills, and been in the habit himself of practically distilling hydrocarbon oils and of examining the contents of his stills during distillation, he would, I think, have discovered the process which he patented, No. 90284, May 18, 1869; for it is a well-known fact to practical refiners of petroleum, that if they distil crude petroleum or hydrocarbon oils the more volatile oils pass over in the first parts of the distillation, leaving the residuum in the still with less and less odors up to the point where decomposition and precipitation of carbon takes place. This
272 deodorization takes place whether you use fire alone or fire and steam, and fire or superheated steam to distil crude petroleum or hydrocarbon oils.

Int. 168. How long in your experience of the distillation of petroleum have you known it to be the fact that the residuum of fire or steam, or steam and fire distillation at ordinary temperatures under atmospheric pressure, becomes to a great extent deodorized as you have stated?

Ans. I have known it for a long time. I may say since 1861, as refers to petroleum.

Int. 169. You have spoken in your testimony of the formation of sulphur compounds as being in your opinion to some extent the cause of the highly offensive odor generated in petroleum distillates by the distillation by fire or fire and steam under atmospheric pressure; state where you suppose such sulphur to exist, and your means of knowledge with regard to this matter.

Ans. I suppose the sulphur to exist in the crude petroleum. By the high temperature used in fire distillation, it forms sulphur carbons, sul-

phide or sulphurated hydrogen, I suppose. The sulphur is found condensed by itself, in the gas-traps and gas-pipes.

Int. 170. State whether or not your trade, in your products of distillation of petroleum, has increased, since the year 1867?

Ans. It has increased every year, very much.

Int. 171. State who, in your opinion, is the largest manufacturer of lubricating oils from petroleum in the United States?

Ans. I believe I am.

Int. 172. State whether you are acquainted with Mr. Samuel Downer or Mr. Joshua Merrill, or either of them?

Ans. Both.

Int. 173. State whether the Downer Kerosene Oil Company have an office in the city of New York, and whether you at any time, and when, exhibited in that office a sample of your neutral topaz oil, and to whom?

Ans. They have an office in the city of New York. I called there during 1868 to examine their oils. Several samples were shown to me by a gentleman who I think was Mr. Green. I examined the oils—they were paraffine oils. I subsequently, during that visit to the office,
273 showed him a sample of my neutral topaz oil. He did—— (Counsel for complainant objects to any statements by the witness of what was said by Mr. Green, or anything done by him.) He did admire it on account of its freedom from the blue tint.

Int. 174. Were you at that visit to the Downer Company office, informed in regard to Merrill's deodorized heavy hydrocarbon oil?

(Counsel for complainant objects to testimony as to anything said or done by any one but the complainant.)

Ans. I was not.

Int. 175. Do you know what connection, if any, Mr. Green has with the Downer Kerosene Oil Company?

Ans. I think he is their agent in New York.

Adjourned the further examination of this witness till 3 p. m.

MARCH 2D—3 p. m.

Met pursuant to adjournment at same place.

Resumed:

Int. 176. State whether or not you at any time showed your neutral topaz oil to Samuel Downer; if so, when and where?

Ans. Mr. Downer called in our office in 1868, after the month of May; I can't fix the time. I showed him my products; among the rest was the neutral topaz oil. He never said anything about the Merrill patent oil. It was the office of Lockhart and Frew, No. 74 Wood street, in the city of Pittsburg. I frequently conversed with Mr. Downer since then, and until the fall of 1869, or early in 1870; I never heard him mention anything about the Merrill oil.

Int. 177. Do you think that the lubricating property of oils is materially dependent upon their gravity; or an important criterion of their value in that respect?

Ans. I do not. For instance, sperm oil has a light gravity; I think about twenty-nine Beaumé. It is a first-class lubricator. Lard oil is about twenty-five gravity; it is a good lubricator. Whale oil is about twenty gravity; it is an indifferent lubricator; it gums very much. White rosin oil is about twelve gravity, and is a poor lubricator. My neutral topaz oil is from thirty-three to thirty-six gravity; it is a good lubricator. This shows that the heavy gravity of oil does not to
274 any extent enhance its value as a lubricator. The degrees I have given above are degrees by Beaumé's hydrometer.

Int. 178. I understand that the higher numbers on the scale of Beaumé's hydrometer indicate the less gravities, and vice versa? Is this correct?

Ans. It is.

Int. 179. Please to explain the construction and use of the oil-gauge shown in Exhibit No. 69.

Ans. "A" is an upright hollow tube closed by a plug at each end. "B" represents a still. "C" is an open tube, which connects with the pipe "A." Communication between the still "B" and the pipe "A" can be opened or closed at pleasure by the cock "D." "E" is a pipe which connects the bottom of the still "B" with the pipe "A." "F" is a cock on the pipe "E" by which communication between the still "B" and the pipe "A" can be opened or closed at pleasure. The cocks marked "G" placed at short intervals along the pipe "A" are the gauge-cocks by which samples of the oil or residuum can be examined at any time. When you wish to take a sample out of the still "B" we will suppose the oil or residuum in the still to be at the dotted line marked "H." You open the cocks "D" and "F;" the residuum will pass by the pipe "E" and cock "F" and rise to an equal height in the tube "A." You then shut the cocks "D" and "F," open the top cock in the gauge to admit air, then take a sample out of any cock below the dotted line marked "H^2." In a vacuum still, special means are provided to shut and open the cocks "D" and "F" at the same time.

Int. 180. Have you any photographic views of your Eclipse Works at the Sharpsburg bridge after its destruction by fire? If so, produce them.

Ans. I produce a photograph of a portion of the ruins of my Eclipse Works at the Sharpsburg bridge. It is marked "Respondents' Exhibit No. 70, J. H. B." On this view "A" represents the vacuum still put up in the spring of 1867. "B" and "C" are vacuum stills put up in the winter of 1867–8. "D" is the vacuum pump-house. "E" is the still for distilling naphtha from crude petroleum. "F" is the superheater. "G" "G" are steam boilers.

Adjourned till to-morrow at 9½ a. m.

275 MARCH 3D, 1871.

Met pursuant to adjournment.

Cross-examination of this witness postponed for the present, at the request of complainant's counsel. And it is hereby agreed that the time of closing testimony upon the part of the respondents be extended for three weeks from March 4th, 1871.

W. BAKEWELL,
Of Counsel for Respondents.
CHAUNCEY SMITH,
For Complainants.

PITTSBURG, *March* 3, 1871.

Deposition of David M. Yeomans.—Recalled.

MARCH 10, 1871.

Dicect examination by Causten Browne, esq., counsel for respondents:

Int. 1. Have you or your firm sold any lubricating oil, composed of paraffine and fat oil, under any other name than that of extra sperm lubricating oil, for mill use?

Ans. We never have.

Int. 2. What paraffine oils have you mixed with fat oils, in making your extra sperm lubricating oil?

Ans. Mostly Coffin's and Lincoln's; small quantities of Moorhouse and Merriam's, of Cleveland, and in one or two instances, Pittsburg oil.

Int. 3. How was this Lincoln oil, so called, made; by what process, if you know?

Ans. By the common process. I've been in the factory, and have understood the whole process from the overseer. Saw nothing but the common mode of manufacturing paraffine oil.

276 Int. 4. Which of the two oils, the Lincoln oil or the Coffin oil, did you prefer and use, when you had it in your store?

Ans. Coffin's.

Int. 5. Which of the two cost you the most, as a rule?

Ans. Coffin's cost us slightly the most.

Int. 6. Up to the year 1869 of which of these two oils did you use the most, in making your extra sperm lubricating oil?

Ans. As near as I can remember, we used considerably the most of Coffin's.

Int. 7. It is testified by Mr. Salmon that you told him that your extra sperm lubricating oil contained eighty-five to ninety per cent. of filtered petroleum. Is he correct about this, and will you also state what you did tell him, and what proportion, if any considerable proportion, you ever put in, and when that was?

(Objected to, both for form and substance.)

Ans. I think he's wrong regarding the statement. I gave him the impression that the mixture was filtered oil and tallow; he asked how much tallow. I replied about twenty per cent. The feeling among cotton-mill agents at this time was much against paraffine oils; in order to secure their trade we used a certain *preparation*, say one-fourth of filtered petroleum, and gave them the impression that our mixture was filtered petroleum and tallow, thereby securing a large trade. The exact mixture at this time was one-fourth filtered petroleum, one-fourth tallow oil, one-half paraffine. We used this mixture up to the latter part of the year 1867. At this time paraffine oil had become so much improved that we gradually decreased the quantity of filtered oil, until we used only about one gallon to the barrel, and this in only one or two cases where we were required to say to the agent, from time to time, that we still used filtered oil. Early in 1868 we dropped the use of it altogether.

Int. 8. Did you ever sell any of your extra sperm lubricating oil to Coburn & Co., of Lowell?

Ans. No.

Int. 9. Has your firm ever sold wool oils, consisting in part of paraffine oil, to woollen mills? If so, since when have you been selling them, and how have they been compounded?

277 Ans. We have sold them since, probably, some time in 1868. We have used Merrill's patent oil, Tweddle's, & Lincoln's, mixed from fifty to seventy-five per cent. of these oils with from twenty-five to fifty per cent. fatty oils, elaine, so called. Elaine is an oil sold under that name in the market; contains palm oil and tallow drips. It is made in the candle factories.

Int. 10. Have you ever had any complaints from customers using the wool oil, made of Merrill's patent oil and elaine? If so, what was the complaint?

Ans. I have had complaints; in one instance only to an injurious extent, where the man complained of the oil smoking badly as the wools passed through his pickers; he thought there was danger of fire in the

use of it, and, I believe, returned a part of the lot which he had not used.

Int. 11. If you sent that customer any wool oil after, which was it?

Ans. I have sent him both Tweddle's and Lincoln's mixture since.

Int. 12. Have you had any complaint from him since?

Ans. No. He has not complained, although he has stated to me at different times that there was some smoke still. I think that any one of the oils will do so more or less.

Cross-examined:

Cross-int. 13. Who is the purchaser of whom you have just been speaking?

Ans. The firm is Colony, Dickenson & Co., at Ashuelot, N. H.

Cross-int. 14. You say you have sold wool oils consisting in part of paraffine oil since some time in 1868. Prior to that period the oil sold by you was not an oil for use in oiling wools, was it?

Ans. No, sir.

Cross-int. 15. What are your firm selling as a wool oil at the present time?

Ans. All three of the oils mentioned, and mixed as I stated.

Cross-int. 16. What proportion of your sales of wool oil consists in part of oil made by use of Merrill's oil?

Ans. I should say fully one-half.

278 Cross-int. 17. What proportion is compounded with Lincoln's oil.

Ans. About one-half.

Cross-int. 18. Is the ex. sperm oil an old and well-known one in the market?

Ans. I have used it since 1864 or '65. I think it's been used by other houses for their mixtures.

Cross-int. 19. Prior to your use of it was not the "Extra Sperm Oil" a well-known term in the oil-market?

Ans. I think not.

Cross-int. 20. Was the Pittsburg oil, which you say in your answer to the second interrogatory you had used in one or two instances in making your extra sperm lubricating oil, the oil known as Tweddle's oil?

Ans. No, sir.

Cross int. 21. What was it?

Ans. It was manufactured by a man named Place.

Direct resumed:

Int. 22. You say that of the wool oils you are now selling, fully one-half is Merrill mixed with elaine, and about one-half is Lincoln mixed with elaine. You also say that you are also selling Tweddle's oil mixed with elaine. Will you explain how it is that you sell Tweddle's mixture as well as Merrill's and yet that about one-half of your sales is of the Lincoln mixture?

Ans. Since the burning of Tweddle's refinery last summer we have had but very little of his oil, and therefore have used the Merrill in its place. I use of Merrill's or Tweddle's, whichever I have in stock. In my judgment they are of equal value for wool purposes.

Int. 23. Where has the Lincoln oil you speak of been manufactured since you have bought it?

Ans. In Cambridgeport and East Cambridge; office in Boston.

Int. 24. What has it been manufactured from?

Ans. So far as I know, from what we call residuum or petroleum-tar.

279 Cross-examined:

Cross-int. 25. Do any of your customers prefer oil made from Merrill's or Tweddle's oil to that made from Lincoln oil?

Ans. I don't know.

Cross-int. 26. How does the price of Lincoln's oil compare with that of Merrill's and Tweddle's?

Ans. About ten cents per gallon less

D. M. YEOMANS.

Deposition of Charles F. Coffin—Recalled.—March 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. Have you furnished any of your paraffine lubricating oil, made as described in your previous deposition, to the Pemberton Mills, of Lawrence, or the Methuen Co.'s Mills, of Methuen, Mass., F. E. Clark agent?

Ans. I have, to both mills.

Int. 2. Through whom was the purchase of this oil by these mills made?

Ans. By Joseph Barney.

Int. 3. Was the oil shipped to the mills directly from your factory?

Ans. It was.

Int. 4. How was it marked?

Ans. "〈B〉 Spindle Oil."

Int. 5. Was this oil your single-distilled or your double-distilled?

Ans. Single.

Int. 6. Have you furnished similar paraffine lubricating oil to other mills, shipping it direct to the mills upon the order of Mr. Barney?

Ans. I have.

280 Int. 7. Name the other mills, with the dates and amounts shipped, as nearly as you can get them from your books.

Ans. Pine Valley Co., 5 bbls. February 5, 1869.
Wilton Mfg. Co., 5 " " " "
Davis Mfg. Co., 5 " " " "

That's all I have here—I may have shipped more.

Int. 8. Have you recently made, or are you making, arrangements to enlarge your manufactory of paraffine lubricating oil?

Ans. I am making arrangements to enlarge it now.

Cross-examination declined.

CHARLES F. COFFIN.

Deposition of Edward S. Thayer, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, March 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Edward S. Thayer; age 33 years; residence at Salem, Mass.; occupation, refiner of heavy hydrocarbon oils.

Int. 2. Give the name of your firm, and state where their place of business is.

Ans. Seccomb, Kehew & Thayer, 40 India street, Boston.

Int. 3. How long have you been engaged in the business you have mentioned?

Ans. We commenced in December, 1861, and have pursued it ever since.

Int. 4. How long have you used for that purpose the apparatus which you are now using, or apparatus of the same construction?

Ans. Ever since we commenced, in December, 1861.

Int. 5. Describe, briefly, that apparatus.

Ans. It is merely a distillation by the aid of superheated steam. The condensers are known to me as upright copper condensers.

281 Int. 6. Do you use a still with provision for fire-heat beneath, and a superheater for superheating steam, to be used in connection with fire-heat, for vaporizing the material in the still?

Ans. I do.

Int. 7. Describe the condenser and the apparatus for receiving the condensed oil.

Ans. As I said before, they are upright copper condensers, with four outlets; we run the oil into tanks or into pails—that depending upon which outlet we are drawing from.

Int. 8. Where do the first or lightest products of your distillation go?

Ans. The lightest products are running all the time; they go into the outside tank—the further end of the condensers.

Int. 9. Does any part of the product run to a refuse tank or other vessel?

Ans. If you call the light oil a refuse, that runs to the outside tank, for the volatile oils.

Int. 10. Where is that outside tank?

Ans. It is outside of our distil-house, in an underground tank or cask.

Int. 11. What is the character of that which runs to this outside tank?

Ans. It is an oil varying from 45 degrees to 60 degrees gravity, and the smell very offensive.

Int. 12. Do you make any use of it; and, if so, what?

Ans. I have sold it to refiners of burning-oil.

Int. 13. What are the gravities of the oil which is collected from each of the other three outlets?

Ans. They vary from 34 degrees down to about 22 degrees. The heaviest is 22 degrees, the next about 28 degrees, and the next about 34 degrees. They vary somewhat, of course, from this, but this is about the average.

Int. 14. How many grades of paraffine lubricating oils do you mak by this apparatus, and what are the gravities of them as finished, ready for market?

282 Ans. We make three standard oils. The heaviest is 24 degrees, the next 27 degrees, the lightest 32 degrees, or 33 degrees sometimes.

Int. 15. How long have you made these standard oils, using the apparatus described in the manner described?

Ans. We have made them all ever since the latter part of 1865.

Int. 16. From what base are these three standard oils respectively made?

Ans. The 24-degree and 27-degree gravity oils are made from tar or distillate, whichever we may happen to have, it makes no difference which. The 32-degree oil is made from Franklin oil. That's what we've been using lately. When West Virginia oil was cheaper we used that principally.

Int. 17. Which of these oils, if either, do you sell pure; and which, if either, do you mix, and with what, and in what proportions?

Ans. We sell the 24 degrees pure, the 27 degrees pure—that is, the bulk of it. We mix the 27 degrees (when we mix it at all) and we mix the 32 degrees with lard, sperm, or whale oil, or tallow, in proportions of anywhere from ten to thirty-three per cent. of the fatty oils.

Int. 18. Do you sell to the trade, or do you supply the mills direct?

Ans. Our standard oils we sell the mills direct—we don't sell them to the trade at all.

Int. 19. Mr. Joshua Merrill has produced as an exhibit a sample of what is called in his deposition "Seccomb's brilliant paraffine oil," said to have been obtained from Mr. Francis Maguire, and to have been given to him by you; do you remember having given him a quantity of such oil?

Ans. I do not remember giving him any oil of any kind. I remember selling him at three or four different times. He would send in an empty barrel and I would fill that half full for him.

Int. 20. What was this "brilliant paraffine oil," so called, which you sold him?

Ans. It was taken at the lightest part of our distillation, at five different times, from our stills.

Int. 21. Was it one of your standard lubricating oils that you have mentioned?

Ans. It was not.

283 Int. 22. How many times have you ever made a batch of this brilliant paraffine oil, so called?

Ans. I've never made but one lot; that was from seven hundred to eight hundred gallons.

Int. 23. When was that?

Ans. During the year 1870.

Int. 24. What use have you put it to mainly?

Ans. The larger part of it I used in bringing up the color of what we call our common paraffine oil. We buy distillate at the West and treat with acids and alkali, and then press it. The product we call our common paraffine oil.

Int. 25. Is this "common paraffine oil" one of your three standard lubricating oils which you have mentioned?

Ans. It is not.

Int. 26. What was the character of this "brilliant paraffine oil," so called, as to color?

Ans. I think it is nearly the best colored oil we have made—that is, with one distillation.

Int. 27. Will you name now the principal mills which you have supplied with your standard lubricating oils, stating as nearly as you can the length of time during which you have supplied them, the annual amount supplied them, and which of the three standard lubricating oils you have supplied them?

Ans. The Cocheco Manuf'g Co. and Print-Works, Dover, N. H.; they had the 27 degrees gravity oil, I think, for one or two years, and from 8,000 to 10,000 gallons a year. The Manchester Print-Works, Manchester, N. H., the 27 degrees gravity oil since '65, I think, from 5,000 to 9,000 gallons per year; the Naumkeag Steam Cotton-Mills, at Salem, Mass., the oil made from 32 degrees for two or three years, about 10,000 gallons per year; the Boston Man'g Co., at Waltham, Mass., the 32 degrees gravity oil for about six years, say 6,000 gallons a year. I could name many other mills if desired.

Int. 28. So far as you know, have these oils given satisfaction to the mills for lubricating purposes?

Ans. So far as I know, they have.

284 Int. 29. Has your business in these oils increased during the last four or five years? If so, state generally the amount of such increase.

Ans. It has been constantly increasing. The last two years we have sold all the capacity of our works would allow us to make.

Int. 30. Did you ever make, by the use of the apparatus you have described, in the way you have described, a paraffine oil for oiling wool?

Ans. We have.

Int. 31. When was that?

Ans. We made it as long ago as '65; I suppose we have made it ever since.

Int. 32. Do you make this wool oil by one or two distillations in the apparatus used?

Ans. I think we've usually made it by two.

Int. 33. What has been your price to the trade for your wool oil sold as such?

Ans. The price has varied during the last five years; say anywhere from 40c. to 80c. or 90c., as I remember.

Int. 34. At what price would you furnish to the trade to-day such paraffine wool oil made by double distillation as you produced five years ago?

Ans. From 45 to 50 cents.

Int. 35. To whom or through whom did you sell your wool oil?

Ans. Either through Lincoln & Smith or Wm. Lincoln & Co.—one of the two; I don't remember just now which.

Int. 36. What do you mean by the expression used a little time ago, speaking of your paraffine wool oil that you made in 1865, "I suppose we have made it ever since." Have you in fact made the manufacture of wool oil part of your business since that year?

Ans. We have. We have made that grade of oil. People can use it for what they choose. I should have said I know we have made it ever since.

Int. 37. Is there a winter lubricating oil and a summer lubricating oil made from petroleum-tar or distillate?

Ans. Yes, sir.

Int. 38. What is the characteristic difference between these two oils?

285 Ans. I don't know that there is any difference in the character of the oils, except that one will chill easier than the other—more of the paraffine wax remaining in one than in the other.

Int. 39. What do you understand by heavy hydrocarbon oils, as that term is used in the trade?

Ans. The petroleum oils, after the naphtha and burning oils have been taken from them.

Int. 40. How long ago did you first use superheated steam for the distillation of oil?

Ans. In 1850 Mr. Seccomb commenced it. It was 1856 before I knew anything about it.

Cross-examined by Chauncey Smith, esq.:

Cross-int. 41. What kind of oil did Mr. Seccomb distill by the use of superheated steam in 1850?

Ans. Any of the oils—animal oils or fish oils.

Cross-int. 42. In connection with the distillation of what kind of oil did you first become acquainted with it?

Ans. All the animal and fish oils, and vegetable oils also.

Cross-int. 43. Do you have the immediate charge of the manufacture of your oils at the present time?

Ans. We have a superintendent who attends to it.

Cross-int. 44. What branch or department of the business do you give your personal attention to?

Ans. I oversee all that is done there, and am supposed to know all that is done there.

Cross-int. 45. In the use of your present apparatus is the superheated steam discharged into the body of the oil in the still, or is it carried through the oil in the pipes and discharged outside of the still?

Ans. It is discharged into the body of the oil.

Cross-int. 46. Was that superheating apparatus for the use of superheated steam in the way you use it the subject of a patent?

Ans. I believe the one we now use is. The one we have been using was not.

Cross-int. 47. Who has the patent on the one you now use?

Ans. I think a man named Howorth may have something to do
286 with it, but my impression is that Mr. Seccomb and a man named Newcomb control it.

Cross-int. 48. How long have you used the superheating apparatus you now have?

Ans. We either put them in in 1864 or 1865, as I remember.

Cross-int. 49. Is Mr. Howorth in your employment, or has he ever been?

Ans. He has been connected with us, but is not at present.

Cross-int. 50. When was he connected with you, and in what capacity?

Ans. I think it was in 1865, in erecting works for retorting coal oils by superheated steam that he was first employed. He was interested in it, and was merely employed in putting up the works.

Cross-int. 51. Under what names do you sell your oils?

Ans. Standard spindle-oil; Seccomb paraffine oil. These are from 24 degrees to 31 degrees gravity. We sel our mixed oils under a variety of names.

Cross-int. 52. At what prices during the past year have you sold your paraffine oils to the several establishments whose names you have given as purchasers?

Ans. From forty cents to one dollar a gallon.

Cross-int. 53. What oil have you sold at one dollar a gallon?

Ans. We have sold both our 27-degrees and our 32-degrees gravity oil mixed with tallow, sperm, or lard oils.

Cross-int. 54. In your answer to 27th interrogatory you mention the names of certain establishments to which you had sold your two standard lubricating oils of 27 degrees gravity and 32 degrees gravity. At what prices during the past year have you sold those oils unmixed to the establishments you have mentioned?

Ans. I should have said that I never sold the 32 degrees unmixed. I never did. The 27 degrees gravity was sold at forty cents, the lowest price.

Cross-int. 55. What is the highest price you have sold it at the past year to the establishments you have named?

Ans. We have sold it at forty cents all along; I don't think we have changed the price of it.

287 Cross-int. 56. Do you mean to be understood that you have sold none of your 32-degrees oil unmixed?

Ans. I do.

Cross-int. 57. In your answer to 27th interrogatory you say you think you sold to the Cocheco Manufacturing Co. and Print Works from eight

to ten thousand gallons a year of the 27-degrees oil; has that all been sold unmixed?

Ans. If I remember right, last August, in that extreme weather, they came and bought a cask of us, and in that cask of oil, I think, at their request, was mixed twenty per cent. of lard. The rest was all unmixed.

Cross-int. 58. How was it with the oil sold the Manchester Print Works?

Ans. It was sold unmixed.

Cross-int. 59. Is not your oil quoted in the market under the names of Seccomb's brilliant oil, and Seccomb's spindle-oil, or Seccomb's standard spindle-oil?

Ans. I know that the Standard spindle-oil has been quoted in the Commercial Bulletin. I did not know that we ever quoted brilliant oil, or that we ever had a stencil "brilliant oil" until Mr. Browne mentioned the name of brilliant oil to me since the first of January last, and since that time I found we did have a stencil, and that the brilliant oil was quoted in the Bulletin. But none of our standard oils have been quoted under the name of brilliant paraffine oil.

Cross-int. 60. What oil was quoted under the name of brilliant?

Ans. I wanted 1,000 gallons of very heavy oil, say 24 degrees or 25 degrees gravity, and from five different distillations I took the lightest product of each and mixed them together and treated them with acids and alkali. I should think there was about eight hundred gallons of the oil. That was the oil quoted as brilliant oil.

Cross-int. 61. Did you sell any of that oil unmixed; if so, how much?

Ans. I can't tell exactly how much; perhaps a dozen or fifteen barrels of it.

Cross-int. 62. Do you know for what price you sold it?

Ans. Yes, sir; I sold some at thirty cents a gallon; some for fifty cents a gallon. I think that was the highest price I ever charged
288 for it. That which I sold for thirty cents was put into the paraffine oil that I sold Mr. Bartlett, to bring up the color. Mr. Maguire sent in at three or four different times four empty barrels, I think, and had them half filled with the oil; and, if I remember right, my partner, Mr. Kehew, sold ten barrels of it in New York.

Cross-int. 63. Was the oil you sold Mr. Bartlett sold unmixed?

Ans. There was one-quarter of this brilliant oil in it to bring the color up.

Cross-int. 64. At what price did you sell this brilliant oil when you sold it unmixed with either paraffine or any other oil?

Ans. I never sold it to but to two parties. Mr. Kehew sold a lot of ten barrels in New York at either forty-five or fifty cents, I don't know which; and Mr. Maguire bought the balance at different times, a few gallons at a time, for, I think, fifty cents a gallon. The lot sold in New York was sold by a sample bottle.

Cross-int. 65. Do you know who procured your oil to be quoted in the Commercial Bulletin under the name of Seccomb's brilliant oil?

Ans. I do not.

Cross-int. 66. Do you know how long the oil continued to be quoted under that name?

Ans. I don't know anything about it.

Cross-int. 67. You have seen a quotation in the Commercial Bulletin under that name, have you not?

Ans. I have.

Cross-int. 68. How long did you see it there?

Ans. At the time Mr. Browne told me of that oil by that name, I

asked Mr. Seccomb if ever he had called an oil that we had made a brilliant oil; he said that he had, and had had it quoted in the Commercial Bulletin. He took up the paper and showed me the quotation. I asked him what he did that for, and there let it drop. That's the last I have seen of it or had anything to do about it.

Cross-int. 69. What did Mr. Seccomb say in answer to your question? (Objected to.)

Ans. He said that he quoted it, and that my partner, Mr. Kehew, said he ought not to have done so.

289 Cross-int. 70. Do you remember the price at which it was quoted?

Ans. I couldn't; I remember nothing but that it was quoted.

Cross-int. 71. Your standard spindle-oil, as I understand you, is always a mixed oil?

Ans. Yes, sir.

Cross-int. 72. You obtain your 27 degrees oil and your 24 degrees oil from distilling petroleum, do you not?

Ans. We do.

Cross-int. 73. What per cent. of each do you obtain from a given quantity of the petroleum oil?

Ans. We obtain of the 27 degrees gravity oil from a good quality of tar seventy per cent. (I understand from petroleum oil and petroleum tar the same thing.) I should judge about fifty per cent. of the 24-degree gravity oil.

Cross-int. 74. What amount of your 27 degrees gravity oil could you obtain from 1,000 barrels of crude petroleum?

Ans. I never used what is called crude petroleum for making that oil. I used the petroleum tar.

Cross-int. 75 After your heavy oil, your 32 degrees gravity oil, your 27 degrees gravity oil, and your 24 degrees gravity oil run from the still, you treat these with acids and alkalies, do you not, to prepare them for the market?

Ans. We do.

Cross-int. 76. In your direct examination you speak of common paraffine oil which you obtain from distillates bought at the West and treat with acids and alkalies, and then press it; in what respect do those distillates which you procure from the West differ from your own distillates before they are treated with acids and alkalies?

Ans. The distillate obtained from the West is a very strong-smelling, stinking oil. That which we make ourselves is free from that objectionable odor.

Cross-int. 77. Is your own distillate to which you now refer a distillate obtained from tar?

Ans. It is.

Cross-int. 78. And do you distil it a second time to obtain your oil which you sell as your 27 degrees gravity oil?

290 Ans. We do not. Perhaps we may once in a while.

Cross-int. 79. Does the chemical treatment which you give to your own oils distilled from tar differ from that which you give to the distillation you purchased at the West?

Ans. We use the same chemicals, but our distillate of the same specific gravity requires less chemicals than the western distillates. If the color of our distillate were all right we could get rid of the odor without chemicals.

Cross-int. 80. I wish to call your attention again to the question of the percentage of oils which you obtain from distilled tar. I understood

you to say that you can and do obtain from such tar as you purchase seventy per cent., sometimes, of your 27 degrees oil, and fifty per cent. of your 24 degrees oil. Did I understand you correctly?

Ans. Yes, sir; I am sure about the 27 degrees, but in regard to the 24 degrees it may vary a little, but not much.

Cross-int. 81. What else do you get in distilling such tar?

Ans. We obtain coke, which remains in the still, and the balance of the oil which comes over is a stinking oil of from forty-five to sixty gravity. This comes over to an outside tank in the yard, about forty feet from the still.

Cross-int. 82. What percentage of this latter oil do you obtain?

Ans. Sometimes more and sometimes less, say from one to two hundred gallons—1,600 gallons of tar in the still.

Cross-int. 83. Will you furnish the complainant in this case with a sample of the oil you have sold during the past year at forty cents a gallon to the Cocheco Mills and the Manchester Print-Works?

Ans. With pleasure, any of our products.

Direct resumed:

Int. 84. In answer to 71st cross-interrogatory, you say your standard spindle-oil is always a mixed oil. What do you mean in that answer by your standard spindle-oil—what gravity?

Ans. I mean the 32 degrees oil. It is 32 degrees before it is mixed.

Int. 85. What names do you give to your 24 degrees, 27 degrees, and 32 degrees oils, respectively, when pure?

Ans. The 24 degrees I think we have never put anything on
291 excepting the gravity. The 27 degrees oil we call "Seccomb paraffine," "X L spindle," and "B spindle." The 32 degrees oil we always mix and call the mixture "Standard A A spindle-oil."

Cross-examination resumed:

Cross-int. 86. What do you mix with your 32 degrees oil to produce your standard A A spindle-oil?

Ans. Different mills require a different mixture; we mix with tallow, sperm, or lard, according to where it is going; anywhere from twenty-five per cent. down to ten per cent. of the fatty oil.

Cross-int. 87. What proportion of the oils that you produce at your work is your thirty-two-degree oil?

Ans. As near as I can judge, to answer right off, I should say one-fifth.

Cross-int. 88. How much, respectively, of your 24 degrees and 27 degrees oils?

Ans. Of the 27 degrees oil all of three-fifths; the rest is, of course, the 24 degrees oil.

EDWARD S. THAYER.

Deposition of G. Granville Mears, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, March 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. G. Granville Mears; age, thirty-eight years; residence, Newton, Mass.; occupation, dealer in oils.

Int. 2. How long have you been so occupied, and state also whether you are connected with any woollen-mills; and, if so, how, and for how long a time have you been so connected?

Ans. I have been in the oil business for the last ten years. I
292 have been connected with the sale of oils to woollen-mills during that time, and particularly to the Saxonville Mill, of Saxonville.

Int. 3. Have you been acquainted during that time with the use of oils at the Saxonville and other mills?

Ans. Particularly so.

Int. 4. Did you ever have, as oil-dealer, a paraffine wool oil of the manufacture of Seccomb, Kehew & Thayer?

Ans. I did, of either Seccomb & Thayer, or Seccomb, Kehew & Thayer, whichever the firm was.

Int. 5. When was that, and how much of it did you have, and what disposition did you make of it?

Ans. It was in 1865; I don't remember the quantity; it was as much as fifteen barrels. I sent it to several mills with a view to introduce it as a wool oil, in substitution for olive oil or lard oils, or oleaic acid oils.

Int. 6. Was it used as a wool oil inany mills with which you were personally connected? If so what, and what line of goods was there manufactured?

Ans. It was used at the Saxonville Mills for carpets, blankets, and, I think, army-cloths.

Int. 7. What was the result of its use at those mills, and, so far as you know, at other mills where it was used?

Ans. A good result; we judged so where no fault was found.

Int. 8. Was the same oil sought for afterwards by the Saxonville Mills or others?

Ans. Yes, sir.

Int. 9. If no more of it was supplied, state, if you know, why not.

Ans. The reasons given me were that they were going to make different, or more extensive, arrangements for manufacturing the oil, and, after waiting a long time for that, I abandoned the hope of getting it.

Cross-examination declined.

G. GRANVILLE MEARS.

293 JUNE 9, 1871.

And now met pursuant to agreement and consent of counsel of the respective parties to this suit, at the office of W. U. Howard, notary public, in the city of Pittsburgh, western district of Pennsylvania.

Present, counsel of respondents.

Deposition of H. W. C. Tweddle.

Examination in behalf of defendants. (Continued from page 275.)

Int. 181. In your patent of December 10, 1867, No. 72126, you say, "I also apply my improved process to the distillation of the residual and lubricating oils produced by fire-distillation." What do you mean there by residual oils?

Ans. By residual oils I mean those oils which run from fire-stills (whether steam or superheated steam is used as an auxiliary or not) at the latter end of the distillation. If the oils are run rapidly from the still, then the oils are yellow, of heavy gravity, from about 34° to 38° Baumé, and contain more or less paraffine. They are unsuitable to mix with the burning oils. It was my practice, from 1861 to 1866, to introduce into fire-stills, towards the latter portion of the distillation, the superheated steam more freely than in the earlier part of the distillation, for the purpose of preserving the bottoms of the stills from the

action of the intense heat of the fire; and consequently I made a good deal of this residual oil, which I consider is the same as the No. 2 oil mentioned by Mr. Merrill in his answer to the first cross-interrogatory. It is the usual practice now, in fire-distillation, instead of running stills rapidly at the latter end of the distillation, to run them slow, and decompose the oil in the still, producing burning oils of very light gravity, sometimes upwards of 60° Baumé. They are light in color and make good burning oils.

Int. 182. In the same patent you say, "the petroleum to be distilled, either crude or deprived of the gasoline, or other more volatile ingredients, etc., is admitted," etc. Why was the petroleum to be sometimes first deprived of its more volatile ingredients, and sometimes not?

294 Ans. Some petroleum contains a larger quantity of gasoline and benzole, and some contain very little or none. Practical operations are better conducted when the crude petroleum contains benzole, if it is distilled off under atmospheric pressure, previous to its admission into a vacuum-still.

Int. 183. You have said that repeatedly during the years 1864, 1865, and 1866, you produced from crude petroleum, by distillation in vacuo, with superheated steam, heavy paraffine oils, with very little odor, and almost devoid of the blue color of fluorescence. What vacuum apparatus did you use for this purpose?

Ans. Experimental apparatus.

Int. 184. There was, if I understand you, no vacuum apparatus in the apparatus you regularly used at the Standard Oil Works, from 1862 to 1866, when you built the Eclipse Refinery?

Ans. None.

Int. 185. The apparatus you so used at the Standard Works was substantially the same as that shown in the drawing, Exhibit No. 43, I. H. B., I believe?

Ans. It was.

Int. 186. You have said that you produced neutral topaz oil in June, July, August, and September, 1867. Was this done by process like or unlike that described in your patent of December 10, 1867, No. 72126?

Ans. It was by the same process.

Int. 187. When did you first introdnce in commerce your neutral topaz oil?

Ans. I sold, I think, small quantities for trial in the fall of 1867, and introduced it into commerce in 1868.

Int. 188. Why was it that it was introduced in commerce so late? And state also what line of the oil-business you were in while you were at the Standard Works.

Ans. At the Standard Works we made nothing but illuminating oil for commercial purposes. In the summer of 1867 I did not do very much business, and I had a demand for dark lubricating oil for railroad and other purposes. I may have sold some of the topaz oil for trial. It was not an oil for which there was a great demand in this locality. In the winter, spring, and summer of 1868 I was busy enlarging my

295 works, and when I had finished doing so I commenced making neutral topaz oil regularly. I did not get my presses up till the winter of 1868 or 1869, when I pressed out the paraffine and introduced the oil into commerce.

Int. 189. You have spoken of some petroleum you bought in the fall of 1864, that came, you believe, from Barren County, Kentucky, and that you treated this oil in an agitator with sulphuric acid precipitating

a heavy deposit of carbonaceous matter. Before so treating the oil, did you vaporize it, or attempt to do so?

Ans. I made several small experiments to test the qualities of the oil, and considered the treatment which I describe in answer to interrogatory 71 as the simplest and best applicable. I did not vaporize it at first, but treated it with sulphuric acid, etc., as it came from the wells. I then distilled it, and retreated the distillate, which had a bad odor. I redistilled again, and treated the distillate again with acid and alkali.

Int. 190. You speak of the residuum obtained from this oil as being substantially the same as that produced by the process of Mr. Merrill, described in his patent No. 90284. State why you tried the experiment, whether you sold the oil so produced; and, if not, why not?

Ans. I purchased all kinds of oils from new oil districts, for the purpose of testing them. I did not sell the residual oil. I was not in the lubricating business; but decomposed it into burning oil.

Int. 191. If you take the residual oil of fire-distillation, spoken of in the passage heretofore quoted from your patent of December 10, 1867, No. 72126, and run it through your vacuum-still, in the manner described in that patent, what will be the residuum left in the still after distilling off the light oils?

Ans. It will be an almost ordorless lubricating oil, dark-yellow in color, which, by chemical treatment, will be like the oil described in Joshua Merrill's patent, No. 90284; it will have paraffine in it, and would chill easily. The process would be nearly the same as that described in Merrill's patent, except it would be in vacuo instead of under atmospheric pressure, less heat being required.

Int. 192. Suppose you take the lubricating oils produced by fire-distillation mentioned in the passage heretofore quoted from your said patent of December 10, 1867, and put them through your vacuum-still,
296 in the manner described in that patent, what would be the oil remaining in the still after the light oil had been carried off?

Ans. A heavy lubricating oil with very little odor, and would be like Merrill's oil. It might require some chemical treatment.

Int. 193. During the summer of 1867, after you got the Eclipse Refinery constructed, what oils did you make for commercial purposes?

Ans. I made illuminating oils, and a heavy dark-green lubricating oil, 25° to 30° gravity. I made some neutral topaz oil. There was a good demand for the dark-green lubricating oil for railroads. I had no facilities if I had wanted to produce neutral topaz oil in large quantities. I had few tanks, no freezing-houses, no presses, etc., which are required to make it.

Int. 194. What are the relative percentages of illuminating oils, lubricating oils, etc., which you produce from crude petroleums?

Ans. They vary very much, indeed. I have produced seventy to eighty per cent. of refined oil, and ten to twenty per cent. of lubricating oils. From some oils I produce seventy per cent. of lubricating oils, and twenty-five per cent. of illuminating oils. The percentages vary very much, and altogether depend on the variety of crude petroleum which is operated on.

Adjourned till to-morrow morning at 9 a. m., at same place.

JUNE 10TH, 1871.

Met at time and place fixed by and pursuant to adjournment.
Present, counsel of the respective parties and Mr. Merrill.

Cross-examination by Chauncey Smith, esq., of counsel for complainant:

Cross-int. 1. You have a pecuniary interest in the result of this suit, have you not?

Ans. Yes.

Cross-int. 2. State what that interest is.

Ans. I am the manufacturer of the neutral topaz oil in question.

Cross-int. 3. Have you not assumed the management of the suit, and retained and paid counsel who are employed in it, or agreed to do so?

Ans. I don't know whether that is a right question to answer.

(Counsel for the defendants inform the witness that in their judgment this is a proper question, whereupon the witness proceeds to answer.)

Ans. I have.

297 Cross-int. 4. Have you not agreed to indemnify the defendants in this suit and save them harmless from any judgment that may be obtained against them?

Ans. Really, I don't know, as a matter of law.

Cross-int. 5. Have you made any agreement with them in respect to the matter?

Ans. I once met one of the partners in the concern, namely, Yeomans and Goss, which of them I really forget.

(At this point the counsel for the defendants inform the witness that having admitted that he has a large pecuniary interest in this case, the question which is now put is in their judgment improper, and he is under no obligation to answer.

The witness thereupon refuses to proceed further in reply to the last cross-interrogatory.)

Cross-int. 6. Have you, from the commencement of the suit, conferred, from time to time, with the counsel of the defendants in regard to the defence, and the manner in which it should be conducted?

Ans. I have.

Cross-int. 7. I suppose you would not be willing to have it assumed that, because you have pecuniary interest in the result of the suit, you would withhold any facts that might be within your knowledge having a bearing upon the result of the suit; or that you would in any way throw any obstacles in the way of the complainant or his counsel in making inquiries of parties who have been connected with you, or with whom you have been in correspondence, verbal or written, in respect to the manufacture of your neutral topaz oil, or in respect to your inventions?

Ans. I don't understand that question.

Cross-int. 8. Perhaps you will understand it easier, to take the different branches of the question separately:

I suppose you would not be willing to have it assumed that, because you have a pecuniary interest in the result of the suit, you would withhold any facts that might be within your knowledge having a bearing upon the result of the suit?

(The counsel for the defendants object to the question, as tending to confuse and mislead the witness, and because it is the purpose of

298 this hearing to have questions put and answered as to matters of fact, and not as to the witness's supposed or possible state of mind; and instruct the witness that he need not answer any such question un-

ess he pleases. The witness thereupon declines to answer the 8th cross-nterrogatory.)

Cross-int. 9. Some parties, to whom we have applied for information, have objected to give it, on the ground that you were unwilling to have them give it, and that they should incur your ill-will and hostility if they did give it. Have you said or done anything to justify such an apprehension on the part of any man?

(The counsel for the defendants instruct the witness that this question also is one not proper to be put, or one which he can be required to answer; and they also object to the question as incompetent for any legal purpose, and insist that if the witness is to be asked what he has said or done, the thing alleged or supposed to have been said or done should be stated to him, plainly, directly, and in the usual manner. Thereupon the witness declines to answer the question.)

Cross-int. 10. Will you authorize the complainant, or his counsel or agents, to say to any man who makes a similar objection hereafter, that you are willing he should communicate any facts within his knowledge having a bearing upon this suit?

(The counsel for the defendants instruct the witness that this question is not proper to be put, nor necessary to be answered, because his duty is to give testimony, not promises. The witness therefore declines to answer this question.)

Cross-int. 11. I don't ask you to give any promises. I ask you to say whether you are now willing that we should say to any man, who makes a similar objection to us hereafter, that you have no objection to his stating to us the facts?

(The counsel for defendants instruct the witness as before; because they understand that the question does ask, not for testimony, but for a promise. The witness thereupon declines to answer this question.)

Cross-int. 12. Are you acquainted with a man in this city by the name of John Gracie, who is in some way, I believe, connected with the firm of Lockhart, Frew and Company?

Ans. I am.

Cross-int. 13. Do you remember going with Mr. Gracie two or three days after the adjournment of the taking of this testimony in March last to the Union Depot Hotel in this city?

299 Ans. I met Mr. Gracie in the Union Depot Hotel in this city—I did not go to the hotel with him—one day in March last.

Cross-int. 14. Were there not one or two other men in company with you at the same time?

Ans. I suppose I saw a dozen people there I knew. There were two gentlemen in company with me at the time.

Cross-int. 15. Who were they?

Ans. One of them, I think, was Mr. Schmidt; the other one was Mr. Harper.

Cross-int. 16. Will you give the full names?

Ans. I don't know their full names. Mr. Schmidt's name is Edward. I don't know Mr. Harper's.

Cross-int. 17. What was the object of your visit there?

Ans. My own particular object?

Cross-int. 18. Your object, and that of those gentlemen who were there in your company; I mean were you there for any object in common with the other gentlemen? If so, what was it?

(The counsel for the defendants object to inquiry as to the "object," understanding by that "purpose," and submit that the question should be addressed to what was said or done at the interview referred to.)

Ans. I don't think that my private business is the subject of investigation to any one.

Cross-int. 19. Do you decline to make any further answer?

Ans. I decline.

Cross-int. 20. Can you tell about how long it was after the adjournment in taking your deposition (which was the third of March) when this visit to the hotel was made?

Ans. I really forget.

Cross-int. 21. It was within a few days, was it not?

Ans. It was.

Cross-int. 22. Do you know a Mr. Joseph Clark, who is, or has been, in the employment of the Brilliant Oil Works, in or near this city?

Ans. Yes.

Cross-int. 23. He was formerly in your employment, was he not?

Ans. For a good many years.

Cross-int. 24. During what time?

Ans. From 1862, I think, to about 1870.

300 Cross-int. 25. Did you not go to the Union Depot Hotel in March last, at the time referred to, for the purpose of seeing Mr. Clark?

Ans. That is my own business.

Cross-int. 26. Did you not, or the gentleman with you, make an effort to see him at that time?

Ans. I believe they did.

Cross-int. 27. Did you not inquire there of a waiter by the name of Miller, but who, I believe, is called Luther, as to whether Mr. Clark was in the house, and did you not send to two or three rooms for the purpose of finding him? I refer now to yourself, personally.

Ans. I did not ask any waiter for Mr. Clark. I sent a waiter to find who were in certain rooms in the hotel.

Cross-int. 28. Was not Mr. Clark one of the men you wished to find?

Ans. That is my business.

Cross-int. 29. Do you decline to give any other answer?

Ans. Yes, I decline.

Cross-int. 30. Did not you or Mr. Gracie send up a card with Mr. Gracie's name on it, to a room where you supposed Mr. Clark was?

Ans. I sent up no card. I don't know anything about what Mr. Gracie did.

Cross-int. 31. Don't you know that a card was sent up to Mr. Clark?

Ans. I don't.

Cross-int. 32. Did Mr. Clark come down?

Ans. I really know nothing about it. I saw Mr. Gracie for a moment at the hotel. I left and came down town.

Cross-int. 33. Did not you tell a waiter at the hotel, after you had sent to two or three rooms to find out who were there, "It's all right; Mr. Clark's coming down," or something to that effect?

Ans. I did not say any such thing.

Cross-int. 34. Did you not know before you left that Mr. Clark was coming down, and did you not purposely step to one side to avoid meeting him?

Ans. I did not know whether Mr. Clark was up or down, or where he was; I did not step on one side to avoid him or any one else.

Cross-int. 35. In your answer to the 27th cross-interrogatory
301 you say you sent a waiter to find who were in certain rooms in the hotel. Whom did you desire or expect to find?

Ans. Really I don't know who the persons were.

Cross-int. 36. Was not Mr. Clark one of them?

Ans. That is my business.

Cross-int. 37. Will you answer directly whether or not Mr. Clark was one of them?

Ans. I decline.

Cross-int. 38. Mr. Clark did go down on receiving Mr. Gracie's card, and promising to return immediately, but he did not. In the afternoon of the same day he met the gentleman again, who was in the room with him, and said that he declined to give any further information as to the manufacture of your neutral topaz oil, because you were influential and would procure his discharge from the place where he was employed. Had you said or done anything to justify him in making that statement, or do you know whether Mr. Gracie or any one had said or done anything of that nature?

Ans. I never said to Mr. Clark that I would get him discharged from any place. What other people said I know nothing about.

Cross-int. 39. Are you willing that Mr. Clark should communicate any facts that he may know relative to your manufacture of neutral topaz oil, or of other oils that you manufacture?

(The counsel for the defendants instruct the witness that this is not a question proper to be put, or that he is required to answer, because he is here to give testimony and not promises.)

Ans. I decline to answer.

Cross-int. 40. A patent has been put into the case by the counsel for the defendants, granted to you December 10, 1867, and numbered 72126, and did you not on the same day have another patent granted to you, numbered 72125?

Ans. Yes.

Cross-int. 41. Did you not also on the 15th of February, 1870, have another patent granted to you, numbered 99975, for an improvement in the manufacture of paraffine and paraffine oils?

Ans. Yes.

Cross-int. 42. In the patent last referred to I find a statement that you have introduced into commerce an oil, which you describe as
302 neutral topaz oil, as a lubricating oil; and the further statement that the lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way. And in the 122d direct interrogatory you were asked, "Do you consider your neutral topaz oil odorless?" and you answer, "I do not, or never did." And again, in the 155th direct interrogatory, you were asked as follows: "The complainant, Merrill, in his answer to interrogatory 13, says, 'since my discovery I know that I can manufacture a heavy hydrocarbon oil, as free from odor and taste as paraffine wax itself, and paraffine is as odorless as granite;' state whether you ever saw any heavy hydrocarbon oil as free from odor as stated by Mr. Merrill;" and you answer, "I never did." And then you are asked again, "Then, I understand you to say that your neutral topaz oil has never been made by you free from odor; is this so?" and you answer, "Never." I wish to know whether from these answers you are to be understood to express the opinion that your neutral topaz oil is a substantially different oil from the deodorized oil described in Merrill's patent.

Ans. It is.

Cross-int. 43. And I suppose you would also consider the process described by you in your patent of 1870 as a substantially different process from the process described in the Merrill's patent?

Ans. There is no similarity or identity between the process by which

I manufacture my neutral topaz oil and the process which is described in Merrill's patent.

Cross-int. 44. My question in terms referred to the process described in your patent of 1870; will you refer in your answer to the process described in that patent, and state what your judgment is?

Ans. The process described in that patent is entirely different from Merrill's.

Cross-int. 45. You have produced a model, marked "Exhibit No. 33," representing, as you say, in answer to interrogatory forty-three, pretty closely the apparatus put up at Kier's Works, at Freedom; and in answer to interrogatory seventy-six you have attempted, by means of this model, to explain an apparatus which you erected in 1867, at your Eclipse Works; but I do not fully understand the explanation of the manner in which the apparatus was worked at the latter place.

303 Will you state whether or not the oil was introduced continuously into the still, in the manner described in your patent numbered 72126, the vacuum being maintained in the still in a similar manner?

Ans. Sometimes the oil was introduced into the still continuously, and dripped over the pipes as long as we desired. We have on a few occasions charged the still more rapidly, until the still was half full, but we still continued the distillation.

Cross-int. 46. Was there used in connection with this still used in 1857 at the Eclipse Works a reservoir into which the residuum passed continuously in the manner described, if I understand it, in your patent numbered 72126, and represented by the model Exhibit No. 35?

Ans. There was a receiver attached to this still, by means of which the contents of the still could be withdrawn intermittently.

Cross-int. 47. In your answer to the 46th cross-interrogatory you say that "sometimes the oil was introduced into the still continuously, and dripped over the pipes as long as we desired." By the pipes you speak of I understand you to mean pipes such as are described in your patent No. 72126 and represented in the model Exhibit No. 35. Am I correct?

Ans. Precisely.

Cross-int. 48. Now, when so used, was a vacuum maintained in the residuum-reservoir as described in your patent, as well as in the still, so that the residuum passed continuously into its reservoir while the distillate was passing continuously into the condenser?

Ans. Our usual practice was to keep in the bottom of the still two or three feet of oil. If the operator desired to do so, he could maintain a vacuum in the receiver and withdraw the residuum continuously while the distillate was passing over to the condenser, or he could withdraw it intermittently if he desired to do so.

Cross-int. 49. If I understand the working of the apparatus described in your patent No. 72126, the distillation was effected while the oil was dripping over the pipes with which the still was provided, the residuum falling into the bottom of the still below the action of the pipes and passing continuously into a reservoir outside of the still. Will you please to say whether I understand it correctly?

Ans. The oil, after dripping over the pipes, does fall to the bottom of the still, but when it reaches there is still more or less sub-

304 ject to the action of the superheated steam escaping from the perforated pipes which are near the bottom of the still. Your understanding of this patent may or may not be correct, because the oil may pass continuously or intermittently. The patent does not say that the residuum must pass continuously from one still to another, or from one still to the receiver continuously.

Cross-int. 50. Does the patent describe any other mode of using the apparatus than that mentioned in my previous question?

The further cross-examination of this witness adjourned till Monday next at 9 a. m.

JUNE 12, 1871.

Met pursuant to adjournment, at 9 a. m.

Present, counsel of the respective parties and Mr. Merrill.

The counsel for the defendants here put in evidence, by leave of the counsel of the complainant, a certified copy of the file-wrapper in the matter of letters-patent granted H. W. C. Tweddle Dec. 10, 1867, No. 72126, for distillation of hydrocarbon oil, marked "Defendant's exhibit No. 70, I. H. B."

Cross-examination resumed:

Cross-int. 50. Answer of witness thereto:

Ans. Nothing can proceed continuously. Everything has an end. The distillation is continuous only as long as it is expedient to carry it on.

Cross-int. 51. Is that all the answer you have to give to that question?

Ans. If Mr. Smith will put his question more explicitly, I will be happy to answer, if my answer is not sufficient.

Cross-int. 52. What was the capacity of the still erected at the Eclipse Works, which you used during the months of June, July, August, and September, 1867?

Ans. From seventy-five to ninety barrels, I should think, was about its capacity.

Cross-int. 53. It was a round still, was it not?

Ans. No.

Cross-int. 54. State what shape it was.

305 Ans. It was an upright cylinder, hemispherical at the top, with a saucer-shaped bottom.

Cross-int. 55. What was the diameter of the cylinder, and what was the depth of the sides at the circumference?

Ans. The diameter was from ten to eleven feet. The depth of the curve was from five to six feet. The height of the dome is equal to half the diameter of the still. The depth of the saucer-shaped bottom was from two feet six inches to three feet and six inches. Consequently the full height of the still was from twelve to fourteen feet. I have kept this still exactly in the same place that it was put in the spring of 1867. The pipes in the interior are still there, and I think the troughs. The pipes on the outside, and cocks, etc., were melted off in the fire last year which destroyed the works. When I speak of the capacity, I do not mean the full contents of the still. I only guess at that being about its capacity.

Cross-int. 56. How many pipes were there for introducing steam and discharging it into the body of the still, and how high above the bottom of the still were they placed—say above the bottom at the centre?

Ans. There was one pipe for introducing steam or superheated steam through perforated pipes into the body of the still; how far it was above the bottom I forget.

Cross-int. 57. State how far above the bottom, as nearly as you can?

Ans. I should say from four inches to a foot.

Cross-int. 58. What was its length within the still?

Ans. I really don't know; the still is subject to examination.

Cross-int. 59. Will you please to answer the question?

Ans. If Mr. Smith built as many stills from that date as I have, I doubt whether he would remember half the pipes that I have introduced.

Cross-int. 60. Will you please answer the question?

Ans. There were several, what their lengths were I don't know.

Cross int. 61. Were these several pipes branches of the one pipe you previously spoke of as having been placed there for the purpose of introducing and discharging steam?

Ans. They were; I presume they are there still.

Cross-int. 62. How many were there of them—state as nearly as you can?

Ans. I don't know.

Cross-int. 63. Can't you give some idea of the number?

306 Ans. I cannot.

Cross-int. 64. Were they all placed on the same level?

Ans. I forget.

Cross-int. 65. Above each of these pipes was there a series of pipes like those described in your patent No. 72126, and represented in your model Exhibit No. 35, for the purpose of carrying steam through the still without discharging it into the body of the still?

Ans. There was.

Cross-int. 66. How many such pipes were there vertically above each pipe for discharging steam into the still?

Ans. I forget.

Cross-int. 67. State as nearly as you can, according to your best recollection.

Ans. There were from a hundred and twenty to a hundred and fifty horizontal steam-pipes in the still. I should say about that number. How many there were vertically over each blow-pipe I don't know.

Cross-int. 68. In the model Exhibit No. 35 there are four such pipes represented, as I understand it. Do you think there were more or less than that number in the still referred to?

Ans. More.

Cross-int. 69. Were there, in all, more than six?

Ans. I should say there were from seven to ten, at least.

Cross-int. 70. And above each of these vertical series of pipes, as I understand it, was a trough for introducing the oil into the still and allowing it to drip down over these pipes?

Ans. There was.

Cross-int. 71. Will you examine this still before your examination is completed, and ascertain the particulars inquired of and that you were unable to answer, and give me a full answer?

Ans. The length of the steam-pipes conformed to the shape of the still, which, as I said, was a round cylinder. Of course, the pipes that were in the centre of the still were longer than those placed nearer the sides. In regard to the details of the still, I would prefer to go and examine it. I have not been in the still since I built it, in the spring of 1867. I do not think it was opened during 1867, 1868, 1869, and 1870 more than three or four times.

307 Cross int. 72. Will you ascertain, at the same time, the diameter of the various pipes?

Ans. I will; or, if Mr. Smith prefers, will have a drawing and model made of the same.

Cross-int. 73. As I understand the matter, this still was designed to be used by allowing the oil to trickle down over the pipes lying between the troughs and the pipes at the bottom for introducing steam into the still. Am I correct?

Ans. It was partially so.

Cross-int. 74. State fully how it was designed to be used.

Ans. It was designed to be used for distilling by trickling down over the pipes; or, if I chose so to do, by allowing the still to partially fill up, and continue distillation.

Cross-int. 75. In your answer to cross-interrogatory 45, I understand you to speak of two modes in which the still was used; did you there speak of the two modes just referred to?

Ans. We used the still in the two modes referred to and in other modes.

(The question being repeated, the witness says:)

Ans. They are.

Cross-int. 76. Did you obtain the same results when you used it in one mode as in the other?

Ans. We did.

Cross-int. 77. When you allowed the still to partially fill up in the last mode referred to in your answer to cross-interrogatory 75, did you fill it up so as to cover the whole or a part of the tubes through which the steam circulated in the still?

Ans. I think only a part of the tubes.

Cross-int. 78. In such case, did you introduce petroleum continually till the distillation was stopped, or did you continue the distillation after you stopped introducing petroleum?

Ans. In such case, when we got the still filled up, we might either continue the distillation with the oil stopped coming in, or we could, and used to, draw the heavy oil from the bottom of the pan into the vacuum-receiver by slightly lowering the vacuum in the still and increasing the vacuum in the vacuum-receiver, until we had drawn a
308 portion or the whole of the heavy oil into the vacuum-receiver; then increasing the vacuum in the still and lowering the vaccuum in the vacuum-receiver, we again opened a connection between the vacuum-receiver and the still, and sucked the oil into the still, and redistributed it by means of the troughs over the pipes. This could be repeated over and over again, as long as the operator deemed it necessary. We did, in fact, use it in both of these ways at discretion.

Cross-int 78 (a). In your answer to the 75th cross-interrogatory you say you used the still in the two modes referred to in that cross-interrogatory and in other modes. What were the other modes?

Ans. What I meant by other modes—I used it in other modes for experiments not here necessary to mention.

Cross-int. 79. Perhaps you may think it unnecessary, but I desire to know what those modes were; will you please describe them?

Ans. The experiments I speak of, the minutiæ of which I don't recollect, had nothing to do with the question at issue, and I decline to answer. The two modes I have described were those which I used with that still in regular practice; the only other mode which I neglected to mention was when we filled the still up at once with petroleum, the same as in ordinary fire-distillation, first distilling off the light oil, then distilling off the paraffine oil, until the operator deemed the charge sufficiently low. By light oils, I mean illuminating oils.

Cross-int. 80. How much did you use it in this last manner?

Ans. Very seldom.

Cross-int. 81. How much crude petroleum did you distil during those months—June, July, August, and September?

Ans. Not more than fifteen hundred to twenty-five hundred barrels, as far as I recollect.

Cross-int. 82. Of whom did you purchase it?

Ans. My first purchase was from James Benney, who delivered it, I think, for the Dilworths; the other purchases I don't remember.

Cross-int. 84. In the 193d direct interrogatory you were asked what oils you made for commercial purposes during the summer of 1867, and you answer that you made illuminating oils, and a heavy, dark-green lubricating oil of from 24 to 30 gravity. How did you work your still in making those oils?

309 Ans. I turned steam on my still from an hundred and thirty to two hundred pounds pressure per square inch. I then introduced the crude petroleum, sometimes deprived of benzole by prior heating and sometimes not. The crude oil was distributed by means of the troughs over the pipes. In two minutes the illuminating oils could be observed running in a stream from the condensers to the vacuum-pump, which maintained a vacuum of from twenty-eight to thirty-one inches in the still—superheated steam was admitted into the blow-pipes at the bottom of the still—the oil was sometimes allowed to accumulate in the bottom of the still until the operator thought enough. By this time the distillate would be thirty-eight Beaumé, and the illuminating oil would be all distilled over. If at this point summer lubricating oil was required, the operator could draw off to the receiver the contents of the still. If he wanted to produce paraffine oil, he could either continue the distillation, after the illuminating oils, only turning the discharge from the pumps into another tank intended for paraffine oil, or he could withdraw the contents of the still to the receiver, and redraw it into the still, and redistribute it over the pipes, when the distillate would be paraffine oil of from 38 to 29 degrees. Superheated steam could be admitted to the horizontal pipes as well as to the blow-pipes, when the operator should choose to do so. The residuum remaining in the still after the paraffine oils were distilled over would be from twenty-four to twenty-six Beaumé. This residual oil last mentioned was a darksgreen lubricating oil; consequently the products of the operations were illuminating oils, paraffine oils, and dark-green lubricating oils. The summer lubricating oil mentioned was about twenty-eight or thirty gravity, and contained a good deal of paraffine and paraffine oil. It chilled easily in cold weather, while that which was twenty-four or twenty-six gravity contained little paraffine, and would not chill so easily. This summer oil was also a dark-green oil. The color of the paraffine-oil distillate, from 28° upwards, was light yellow.

Cross-int. 85. I believe you had no other still in operation at the Eclipse Works during the months referred to in 1867?

Ans. I had a still for distilling off the benzole from the crude oil prior to its introduction into the still. That was all.

310 Cross-int. 86. You have not spoken of using the still in which you produced your illuminating and other oils, after September, in the year 1867, and during 1868, before the month of May. State whether you did continue to distil oils in that still between those times?

Ans. I don't think we did. It might have been used, but to no great extent.

Cross-int. 87. Who worked for you in carrying on your business of distilling during the months of June, July, August, and September, 1867?

Ans. Joseph Clark and Mr. Jos. Freeman.

Cross-int. 88. Where is Mr. Freeman now?

Ans. He is my foreman. He is the manager of my works at Aladdin, about thirty miles from Pittsburgh.

Cross-int. 89. To whom did you sell the oils which you produced in 1867?

Ans. The illuminating oils I sold in New York, I think. Some of the lubricating oils I sold in Pittsburgh, to Dixon, Stewart & Company, and others, whom I forget. I refer to the dark-green lubricating oil. My papers were all destroyed by the fire. I have no records or recollection of any other purchasers.

Cross-int. 90. In your answer to 187th direct interrogatory, you say you think you sold small quantities of neutral topaz oil for trial in the fall of 1867. To whom did you make those sales?

Ans. As I stated before, I do not now recollect to whom I made those sales.

Cross-int. 91. At what time did you procure your presses, freezing-tanks, and other apparatus required for expressing paraffine from the oil and preparing it for the market?

Ans. I never prepared any freezing-tanks, and am not aware that such are necessary; but I built in the summer and fall of 1868 my presses and other apparatus for freezing and expressing the oil from the paraffine.

Cross-int. 92. Who worked for you in building that apparatus?

Ans. Mr. Joseph George and others.

Cross-int. 93. Can't you give the names of the other parties?

311 Ans. Mr. Joseph George is a master-carpenter. He had his own employés, who are the others I refer to, whose names I forget.

Cross-int. 94. What kind of press or presses did you build for expressing the oil from the paraffine?

Ans. They were built of wood, with iron braces. The pressure was obtained by hydraulic jacks.

Cross-int. 95. Who made these hydraulic jacks?

Ans. I presume they were made by Dudgeon, of New York.

Cross-int. 96. Of whom did you procure them?

Ans. I really don't know.

Cross-int. 97. Where did you procure them?

Ans. Hydraulic jacks are in as common use as bars of steel or chisels. I cannot remember all the petty details of my business.

Cross-int. 98. How many did you have of them?

Ans. Two or three. Sometimes I borrowed of my friends, Lockhart and Frew, or some other refiners in my vicinity, when my own were out of order. Now I remember I had several screw-jacks about my factory, which were sometimes used in place of hydraulic jacks.

Cross-int. 99. Did you procure the hydraulic jacks first mentioned in Pittsburgh?

Ans. I presume I did.

Cross-int. 100. Will you not reflect, and try and recollect of whom you procured them?

Ans. I cannot; only I have the men who used them.

Cross-int. 101. Who were the men who used them?

Ans. Mr. Freeman, Tine Holley, or Hollar, and others, whose names I forget.

Cross-int. 102. Where is the last-named person?

Ans. He is my foreman cooper at my works at Aladdin.

Cross-int. 103. What makes you think these presses were made by Mr. Dudgeon?

Ans. Because I think most of the hydraulic jacks and punches

which I have been in the habit of using on the construction of different works were made by him.

Cross-int. 104. Mr. George, I understand you, built the wood-work paraffine-presses?

312 Ans. He did.

Cross int. 105. Where is he now?

Ans. I presume he is in this country; but where, I do not know.

Cross-int. 106. Did you not some time build or procure a hydraulic press for expressing the paraffine from the oil?

Ans. I did build a hydraulic press.

Cross-int. 107. When did you do that?

Ans. I commenced it, I think, in the spring of 1869. I built the most of it in my own machine-shop at the works.

Cross-int. 108. After you commenced preparing paraffine for sale, whom did you employ in that branch of your business?

Ans. Tine Holley, who had charge of pressing paraffine, also had charge of the hydraulic press for pressing the crude paraffine and refining it. He had numbers of other men under him, whose names I don't know.

Cross-int. 109. Whom did you employ in the distilling of your oils, and preparing them for the market, after you commenced making neutral topaz oil commercially?

Ans. Mr. Freeman, Mr. Strauser, and another man whose name I really forget at the present moment. I will give it to you presently.

Cross-int. 110. Where are Mr. Strauser and this other man at present?

Ans. I presume they are at my works at Aladdin.

Cross-int. 111. And they are in your employment now, are they not?

Ans. They are.

Cross-int. 112. Was not Mr. Joseph Clark, who has been mentioned before, the foreman of your works, or superintendent?

Ans. He was until the summer of 1868.

Cross-int. 113. You have spoken in your direct examination of erecting two stills, which you put in operation about May, 1868, and which are represented substantially by model Exhibit 35; did you, subsequently to that time, erect any other still; if so, when, and how many?

Ans. I did subsequent to that time. I erected one large still at my own works at Sharpsburg, and three vacuum-stills at the Aladdin Refinery. I built the stills for Aladdin during the fall, winter, spring, and summer of 1867–'8. I ordered the stills for Aladdin about Au-

313 gust or September, 1867. The large still I built in the winter, spring, and summer of 1869–'70.

Cross-int. 114. Describe this last still built at your own works.

Ans. The large still was a horizontal cylinder still, about ten feet diameter and twenty feet long.

Cross-int. 115. State whether or not it was provided internally with substantially the same apparatus as that shown in Exhibit No. 35.

Ans. The still in question was put in operation the day before my works were destroyed last year. The operation going on was incomplete. It has again been put in operation, at my new works at Aladdin. Regarding its construction, I decline to say anything, as the experiments intended in 1867, and at present, during its operation, are new, incomplete, and not yet patented.

Cross-int. 116. I did not ask you what it contained internally, either when put up at the Eclipse Works or now; what I asked you was

whether it contained, when built at the Eclipse Works, an internal apparatus like that shown in Exhibit No. 35, which has been patented?

Ans. I decline to answer what that still contains.

Cross-int. 117. Do you decline to answer whether it contained, when put up at the Eclipse Works, an apparatus like that shown in the model, Exhibit No. 35?

Ans. It did not.

Cross-int. 118. Did you make provision, when building that still at the Eclipse Works, for heating it by fire-heat, either with or without steam?

Ans. I decline to answer anything regarding that still or the experiments intended then and now.

Cross-int. 119. Have you now described all the stills for distilling oil erected at the Eclipse Works at the Sharpsburg bridge?

Ans. I believe I have.

Cross-int. 120. While you were manufacturing commercially at the Eclipse Works, at the Sharpsburg bridge, your neutral topaz oil, and paraffine, what percentages, on an average, did you obtain from crude petroleum, of naphthas, illuminating oil, neutral topaz oil, paraffine, and residuum?

Ans. There was no average. Crude petroleums vary very much in the results which they give.

314 Cross-int. 121. Well, can't you state what the average of such results was in your manufacture?

Ans. I have obtained seventy to eighty per cent. of refined oil, and twenty to twenty-five of lubricating-oils—the balance benzoles. Also, thirty-eight per cent. of refined oil, thirty per cent. of topaz oil, twenty per cent. of heavy, green lubricating oil, and no benzole. I have obtained twenty-five per cent. of illuminating oil, fifty to fifty-five per cent. of neutral topaz oil, twenty per cent. of dark-green lubricating oil, and no paraffine. Sometimes crude oils gave as high as twelve to sixteen pounds of pure paraffine per barrel, sometimes none, or very little. It all depends upon the quality of the crude oil and the wells from which it is obtained. The percentages are very irregular; sometimes I make eighty-five per cent. to ninety per cent. dark-green lubricating oil, and ten per cent. of illuminating or refined oils, and no benzole.

(The terms illuminating and refined oils are, it is agreed, generally used as synonymous in the trade.)

Cross-int. 122. Perhaps you misunderstand my question. I did not ask you what you had obtained on special occasions or from special kinds of oil, nor did my question relate to any results obtained when you were not manufacturing neutral topaz oil and paraffine for commerce; nor did it extend to anything you had done at any other place than at the Eclipse Works, at the Sharpsburg bridge. Now, I want to know, as nearly as you can give it, what proportion of the crude petroleum, distilled by you, under the conditions named, was illuminating oil, what proportion was neutral topaz oil and paraffine, what proportion was residuum, and what proportion, if any, was naphtha or benzole?

Ans. In answer to the previous question, I referred to my operations at the Sharpsburg bridge. I purchased a great variety of crude oils. My purchases were usually in small lots. The results were according to the oils I wished to obtain, and I did not take the average of my whole year's work at any time. The answer to the previous question, I think, covers the whole ground.

Cross-int. 123. From the time you commenced to manufacture neutral topaz oil commercially till the time your works were burned in

1870, you distilled a quantity of crude petroleum in such a manner
315 as to produce illuminating oil, neutral topaz, paraffine, and residuum, did you not?

Ans. I did.

Cross-int. 124. Now, can you state, either accurately or approximately, what that quantity was?

Ans. I cannot.

Cross-int. 125. Can you form any judgment as to the quantity?

Ans. I cannot. It would be utterly impossible.

Cross-int. 126. Do you think it amounted to as much or more than fifty thousand barrels?

Ans. I should think getting near to fifty thousand barrels.

Cross-int. 127. Now, can't you form some judgment as to the amount of illuminating oil you produced from that quantity of crude petroleum?

Ans. I cannot.

Cross-int. 128. Nor the amount of neutral topaz and paraffine?

Ans. I cannot.

Cross-int. 129. Do you mean to be understood that it is impossible for you or other men skilled in the distilling of oils to form any judgment as to the results which might be expected under any particular mode of distilling or treatment of the oil from a given quantity of crude petroleum, as found in the market, say from one hundred thousand barrels?

Ans. If Mr. Smith will make his question more explicit as to the manner in which the oil is to be distilled, I will try and answer the question.

Cross-int. 130. Well, distilled in the manner you distil oil when you make illuminating oil, neutral topaz oil, paraffine, and residuum, and carry on the process in the mode to produce the most profitable result.

Ans. I take as a basis a late run of twelve thousand barrels of crude oil. It produced, as near as I can say, from one hundred thousand barrels of crude oil, fifty thousand barrels of neutral topaz oil, twenty-five thousand barrels of green lubricating oil, twenty-five thousand barrels of refined oil, and no paraffine. I mean by green oil, residuum. I mean I obtained at that rate from a run of twelve thousand barrels. I did not take out any paraffine, because it would not pay to take out, there was so little in it.

Cross-int. 131. Suppose you take one hundred thousand barrels
316 of the ordinary Oil Creek oil of commerce—from forty to forty-seven gravity—what amounts of illuminating oil, neutral topaz oil, paraffine, and residuum could you expect to obtain, when distilling the oils, to produce those products in the manner you practised at the Sharpsburg bridge?

Ans. You would obtain from forty gravity about five per cent. of benzole, seventy per cent. of burning oil, fifteen per cent. of neutral topaz oil, and ten per cent. of residuum, and paraffine about eight to twelve pounds per barrel. From forty-seven gravity you would obtain about eighteen per cent. of benzole, sixty per cent. of illuminating oil, about fifteen per cent. of topaz oil, and about seven per cent. of residuum, and about the same amount of paraffine as before, generally a little more. These are about the proportions, but they vary very much, according to the wells from which they are obtained, although all from Oil Creek. I have never purchased any oil from Oil Creek and kept the average of production.

Adjourned till 3½ p. m.

3½ P. M.

Met pursuant to adjournment. Present, as at morning.

Cross-examination resumed:

Cross-int. 132. What kind of oil was the twelve thousand barrels you referred to in your answer to the 130th cross-interrogatory?

Ans. I decline to answer.

Cross-int. 133. While you were manufacturing neutral topaz oil at the Eclipse Works, at the Sharpsburg bridge, about what were the prices at which you sold neutral topaz, paraffine, illuminating oils, and the residuum?

Ans. When first I began to sell orders, I think the price of refined oil was about twenty-five cents; neutral topaz oil, seventy to eighty cents, I think; heavy, green lubricating oil, twenty-five to thirty-five cents. I did not sell any refined paraffine until the spring of 1870. I accumulated all the stock which I had made in the preceding years since May, 1867. I sold the paraffine at eighteen to twenty-five cents per pound.

317 In the spring of 1870, I forget what the price of illuminating oils was—should think about twenty-seven cents; neutral topaz oil, in small lots, fifty-two and a half to fifty-five; in large lots, one to five hundred barrels, fifty cents; dark lubricating oils, about thirty cents; paraffine, from eighteen to twenty-five cents, according to quality and quantity.

Cross-int. 134. Can you state the weight of a gallon of refined oil?

Ans. It varies according to gravity. We sell all our oils by weight, at from six to six and a half pounds to the gallon.

Cross-int. 135. In the 78th direct interrogatory you were asked, after you had described the first still which you put into operation at the Eclipse Works in May or June, 1867, what you purposed manufacturing at those works; and you answer "burning oils, lubricating oils, and paraffine." The 137th interrogatory is as follows: "After making the neutral topaz oil, between June and September, 1867, at the Eclipse Works, did you or not make any effort to interest any other party with you, or to get up a company to manufacture that and your other oils? if so, state when and with what result;" and you commence your answer by saying, "In September, 1867, I tried to organize a company to assist me in enlarging and carrying on the refining operations at my works. I went to New York in the latter part of September, 1867, with that object in view." Did you make any effort here in Pittsburg to interest other parties in your inventions, or to form a company to become interested in them?

Ans. I did.

Cross-int. 136. What were those efforts?

Ans. Simply talking, generally, to the different parties whom I knew, about my intentions.

Cross-int. 137. Can you mention the parties you talked to?

Ans. I talked to a great many parties: Messrs. Lockhart and Frew, Mr. Kier, Mr. Myers, (C. T.,) of Philadelphia, and others, I forget whom.

Cross-int. 138. Did you publish in the papers, or cause to be published, any account of your improvements?

Ans. I really forget whether I did or not.

Cross-int. 139. Will you reflect a moment, and see if you can recollect whether you published or caused to be published in the

318 Pittsburgh Commercial any articles during the months of August or September, 1867?

Ans. I really forget whether I did or not.

Cross-int. 140. Will you look at the printed slip marked "Exhibit No. 71, I. H. B.," which I now show you, and after reading it, will you state whether this slip recalls anything to your recollection as to the publication of articles in that paper?

Ans. I presume that that was written by some of the reporters who used to visit my works. I do not remember anything further about it at present.

Cross-int. 141. What is your recollection as to its having been written and published at your request and at your expense?

Ans. I do not think it ever was published at my expense. I may have suggested the publication.

Cross-int. 142. Do you know what reporter prepared it?

Ans. I do not.

Cross-int. 143. Are you sure that you did not pay the reporter for its preparation, and pay the paper for its insertion?

Ans. I am sure I do not know.

Cross-int. 144. Can you ascertain either or both of those facts?

Ans. I cannot, except the proprietors of the newspaper choose to give the information.

Cross-int. 145. Will you make inquiries of the proprietors and ascertain the fact, if they are willing to give it?

Ans. I will.

Cross-int. 146. Will you also look at the slip marked "Exhibit No. 72, I. H. B.," and state whether or not you have any recollection of procuring this article to be written and published?

Ans. I presume some of the reporters have written it at my suggestion. I am not sure that I ever suggested it.

Cross-int. 147. There is a reference in this article to a prospectus, which it is said will be found in another column; will you look at the slip now shown you, marked "Exhibit No. 74, I. H. B.," and state whether you prepared, or caused to be prepared and published, that prospectus?

Ans. I did.

Cross-int. 148. While making your inquiries at the office with respect to Exhibit No. 71, I. H. B., will you also ascertain, if you can,
319 whether you paid for the publication of Exhibit No. 72, I. H. B., and also whether the articles were published at the dates that are printed at the heads of the slips?

Ans. I will.

Cross-int. 149. Will you look at the three slips marked "Exhibits Nos. 74, 75, and 76, I. H. B.," and state whether you prepared, or caused to be prepared, these articles, and procured their publication?

Ans. I have no doubt that I suggested their publication. I may possibly have prepared portions or a sketch of the articles.

Cross-int. 150. Did you not probably see all of these articles that I have produced before their publication?

Ans. I may and may not. I don't think that I did.

Cross-int. 151. Did you see any of them beside the prospectus after they were prepared and before they were published?

Ans. I do not remember.

Cross-int. 152. Will you ascertain from the publishers the same particulars respecting these last three articles that you are asked as to the others?

Ans. I will.

Cross-int. 153. The article Exhibit No. 75, I. H. B., is headed, the report of the committee appointed to examine Dr. H. W. C. Tweddle's process of manufacturing petroleum oil, and it commences, "We, the undersigned, a committee organized to report on the efficacy and practicability of Dr. H. W. C. Tweddle's process of refining petroleum, assembled at the Eclipse Refinery Monday afternoon, September 9th, and thoroughly tested the apparatus, and examined the oils produced by it." Do you know how that committee was appointed?

Ans. I do not. I presume among themselves at my suggestion.

Cross-int. 154. Were you present when the committee met and when the experiments were performed?

Ans. I was.

Cross-int. 155. The statement which this contains of the experiment is as follows: "At 2.05 p. m. crude oil, 43 degrees gravity, was introduced into the apparatus and steam turned on. In four minutes the refined oil made its appearance, and in seven minutes was running a copious stream. About fifty barrels was introduced by 3.30
320 o'clock, and at 7 o'clock p. m., or five hours' time, seventy-four per cent. of refined oil was produced, and twenty-two per cent. of lubricating oil."

(I read the last passage as corrected in the same newspaper the next day.)

I understand from this that the oil was run into the still continuously for an hour and twenty-five minutes, and that it then ceased to run in, and the distillation proceeded upon the mass of oil in the still until the termination of the experiment. Do you remember whether that was the method in which the experiment was carried on?

Ans. I presume, in the main, it is partially correct. During the earlier part of the experiment one of the steam-pipes in the still burst, and the operation, although it was apparently satisfactory to the committee present, was unsatisfactory to myself, who knew that something was wrong in the interior of the still, which caused the operation to be not so satisfactory as it ought. A day or so afterwards we discovered that one of the steam-pipes had split, or a joint blown out, I forget which. The question being repeated, I say that I think that the introduction of the oil was interrupted several times on purpose to find out what would be the effect. I knew something was wrong in the still, and tried to discover the cause. The method suggested in the question was the method pursued, except that the introduction of the oil was interrupted several times to try and ascertain what was the trouble in the still; but I think more or less oil was introduced more slowly into the still towards the latter end of the operation. The earlier introduction of the oil was rapid. The crude petroleum used in this operation I do not think was heated prior to its introduction into the still.

Cross-int. 154ª. Do you recollect whether the results stated as to the production of illuminating and lubricating oils are correct?

Ans. I presume they are.

Cross-int. 155ª. Did you publish anything else to use in getting up the company which you proposed to form?

Ans. I did.

Cross-int. 156. What was it?

Ans. A prospectus.

Cross-int. 157. In what way was that prospectus published, and in what form?

Ans. As a pamphlet.

321 Cross-int. 158. Have you got one of those pamphlets?

Ans. I think I have.

Cross-int. 159. Will you produce it and annex it as an exhibit?

Ans. I will.

(The witness here produces a small pamphlet, which is marked "Exhibit No. 77, I. H. B.")

Cross-int. 160. When did you publish this pamphlet?

Ans. In the autumn of 1867, on the 15th day of August.

Cross-int. 161. Did you use this pamphlet in New York in your efforts there to get up a company?

Ans. I did.

Adjourned till to-morrow, at 9 a. m.

JUNE 13TH, 1871.

Met at same place, pursuant to adjournment.

Present, counsel of the respective parties and Mr. Merrill.

Cross-examination resumed:

Cross-int. 161ª. In your answer to the 177th direct interrogatory you say that you introduced your neutral topaz oil into commerce in 1868; and in answer to the 188th direct interrogatory you say, among other things, "I did not get my presses up until the winter of 1868–'9, when I pressed out the paraffine and introduced the oil into commerce." I understand from these two answers that it was not till the latter part of 1868 you introduced your neutral topaz into commerce; am I correct?

Ans. You are not correct.

Cross-int. 162. State, then, more definitely when you did introduce it into commerce.

Ans. In the summer of 1867 I made neutral topaz oil, and sold and gave away some of it for the purpose of being tested, with the paraffine in for summer use. It is not essentially necessary to abstract the paraffine even for winter use, for it can be used in warm factories as well as if the paraffine is separated from it. I did not commence to press till the fall of 1868, or the winter. I really can't tell which. It was cold enough to chill the paraffine. My first freezing was done by
322 natural cold, by setting the barrels out in the open air. I had no freezing-house till the spring of 1869.

Cross-int. 163. Do you mean to be understood by your last answer that all the neutral topaz oil, as you now call it, which you sold or gave away to be tested in 1867 had the paraffine in it?

Ans. All, except a small quantity which I expressed on a small scale, after freezing it.

Cross-int. 164. Now, can you tell to whom you sold or gave any of that oil, either with or without the paraffine in it, which you made in 1867?

Ans. I cannot, but think that to-day or to-morrow I can give you the names of different parties; all my memoranda on the subject have been destroyed by fire.

Cross-int. 165. I understand from your answer to the 140th direct interrogatory, that at that time you called that oil spindle oil?

Ans. Sometimes I called it spindle oil, sometimes I called it machinery oil, and may have called it by other names. I don't think that I adopted the name neutral topaz until the fall of 1868.

Cross-int. 166. What time in the fall did you adopt the latter name?

Ans. I really forget.

Cross-int. 167. When in the latter part of 1868 you expressed the paraffine from your neutral topaz oil, and introduced it into commerce,

as you have stated in your answer to the direct interrogatory 188, to whom did you make your first sales of the oil with the paraffine expressed?

Ans. I really forget. I carried on a very large business, and cannot be expected to remember all the minutiæ and details, which I left mainly to others. My books and memoranda on the subject were destroyed when my refinery was burned in June, last year. My book keeper, Mr. Henry D. Foster, who had charge of the details of my business, lost his life in the fire.

Cross-int. 168. Can't you remember the name of any man who purchased from you neutral topaz oil, with the paraffine expressed, in the latter part of 1868 or the early part of 1869?

Ans. I cannot at present. I have put on foot inquiries, and think I shall be able to give you, within a day or so, the names of parties who purchased neutral topaz oil, or what I now call neutral topaz oil,
323 from which the paraffine had not been expressed, in the years 1867 and 1868, and who purchased it in 1868, after the paraffine had been expressed.

Cross-int. 169. Can you name a single party who purchased from you in 1869 neutral topaz oil with the paraffine expressed?

Ans. The Manhattan Oil Company, of New York, had, I think, several hundred barrels. Mr. J. R. Bartlett, of Boston, had some; he is my agent in Boston.

Cross-int. 170. When did you first send neutral topaz oil to Mr. J. R. Bartlett? I mean oil with the paraffine expressed.

Ans. I really don't know.

Cross-int. 171. State as nearly as you can.

Ans. I think the first shipments to Boston were in 1869.

Cross-int. 172. What time in 1869?

Ans. I really don't know.

Cross-int. 173. State as nearly as you can.

Ans. I think in the spring.

Cross-int. 174. When did you first make shipments to the Manhattan Company, at New York?

Ans. I cannot tell.

Cross-int. 175. State as nearly as you can.

Ans. I cannot be positive when it was.

Cross-int. 176. I do not ask you to be positive. I ask you to state as nearly as you can, to the best of your recollection.

Ans. I really cannot remember. I have sold them so much oil and so many lots that is is utterly impossible.

Cross-int. 177. Can't you state about what time in 1869 you began to make shipments to the Manhattan Oil Company?

Ans. I have politely replied to your interrogations on this subject, and again say that I cannot remember.

Cross-int. 178. Can you name any other parties to whom you sold neutral topaz oil, with the paraffine expressed, during the year 1869?

Ans. To George Partridge, of St. Louis, and others there, whose names I forget.

Cross-int. 179. Have you given me the names of all the parties whom you recollect making sales to in 1869 of the oil referred to?

Ans. I have.

324 Cross-int. 180. Have you ever sold paraffine oil with the paraffine not expressed or taken out, under the name of neutral topaz oil?

Ans. I have.

Cross-int. 181. To whom, since 1867, have you made such sales?

Ans. I have sold large quantities of it; but I am not sure but that such information, if I give it, can be used by the plaintiffs in this case to the prejudice of my business.

Cross-int. 182. I repeat my question, and insist upon an answer.

(The counsel for the defendants instruct the witness that the question appears to them to be a proper one and to be pertinent to the issue, and that he may be required to answer it; that being so, notwithstanding that the answer may be used by the plaintiff to the prejudice of his business.)

Ans. I decline to answer.

Cross-int. 183. Will you state what kind of oils you were making and selling from May, 1868, when you resumed the distillation of oils with the new stills represented by Exhibit No. 35, up to the time you commenced separating the paraffine from the paraffine oils, in the latter part of 1868?

Ans. I made illuminating oils, amber oils for lubricating, amber machinery oils for lubricating, which was composed of five to ten gallons of amber oil to thirty or thirty-five gallons neutral topaz oil, with the paraffine in it. I made spindle oil, locomotive oil, railroad-axle oil, for summer use and for winter use. I made tanners' stuffing oil, which was a heavy, green residuum oil of distillation, twenty-five to twenty-six gravity. Of this latter oil I sold large quantities to the Lightfoot Company, for tanning purposes; and I sold the neutral topaz oil, with the paraffine in it, also wool oil and head-light oil.

Cross-int. 184. Under what name did you sell during the period referred to the oil which you call neutral topaz oil with the paraffine in it?

Ans. The barrels were always branded "Eclipse," with my own name on them. The oil might have been designated spindle or machinery, either one or the other; maybe something else; maybe wool oil, or all of them.

Cross-int. 184ª. To whom did you make sales at that period of that kind of oil, under those names?

325 Ans. I really cannot remember, positively, the names of any one of them.

Cross-int. 185. Can you give the names of any parties whom you think you made sales to?

Ans. I do not remember.

Cross-int. 186. Were the amber oils which you referred to in the answer to the 183d cross-interrogatory the same as those you described in your direct examination as that produced from the Smith's Ferry oil?

Ans. They were.

Cross-int. 187. Will you describe the oils which you speak of in your answer in the 183d cross-interrogatory as spindle-oil, locomotive-oil, and railroad-axle oil?

Ans. The spindle-oil was neutral topaz oil, with the paraffine in. It might sometimes have been mixed with a small proportion of lard oil or whale oil. The locomotive oil was made usually in the same manner with a larger proportion of lard oil. The railroad-axle oil was the dark green oil which remained after the illuminating oil and the neutral topaz oil were taken from it, and was made of different gravities.

Cross-int. 188. Will you describe the method or methods in which you conducted your distillation in your stills during that period?

Ans. The crude petroleum was introduced into a still and heated by

steam, and the benzole, if there was any in the oil, was distilled off into its appropriate receiver. Steam *and* [or] superheated steam was admitted, or both, into the stills, by the proper pipes. A vacuum was produced in all of the stills by means of a large duplex-pump. The heated crude oil was sucked into the upper still from the still where the benzole was taken off. It is distributed over the pipes by means of the troughs at such rate as the operator desired. In passing over the pipes, the illuminating oils were evaporated off; after a time, when the operator desired, the cock which connects the bottom of the upper still with the distributing-pipe in the still below it was partially opened, so as to permit the oil which accumulated in the bottom of the upper still to flow and be distributed by means of the troughs over the pipes in the second still, in which a higher temperature was maintained. The oil, in flow-
326 ing over the pipes in the second still, distilled over as paraffine, or neutral topaz oil, from thirty-eight to twenty-eight Beaumé. The illuminating-oil which distilled from the upper still went over and was condensed in its condenser. One of the vacuum-pumps was connected with this condenser and pumped the illuminating oil to its appropriate tank. The vapors of paraffine oil from the second still were conducted to a separate condenser. One of the pumps was connected with it and pumped the paraffine oil to its appropriate tank. Sometimes we ran from the second still to the third still, in which a still higher temperature was maintained, where a further portion of paraffine oil was distilled over. It also went to a separate condenser; but the product of paraffine oil was conducted by the same pump that pumped the paraffine oil from the second still, so that the paraffine oils from the second and third stills were mixed together when they reached the pump. The residuum was conducted by an appropriate pipe from the bottom of the third still to a vacuum-receiver. I neglected to state that a pipe connected the bottom of the second still with the distributor in the third still, by means of which the oil was conducted to the troughs placed over the steam-pipes in the third still. A cock on this pipe regulated the flow from the second and third stills. A cock is also placed on the pipe which leads from the third still to the vacuum-receiver, to regulate or stop the flow. Pipes also went from the bottom of each still to the vacuum-receiver, on which were placed cocks. A pipe led from the bottom of the vacuum-receiver back to and connected with the supply-pipe of each still, so that, if desirable, any oil in the receiver could be brought back and distributed over the pipes in any or all of the stills, simultaneously or successively, as the operator desired.

Cross-int. 189. The third still which you have spoken of as sometimes using in connection with the other two was the one put up in 1867, I suppose?

Ans. It was. I neglected to state in my answer to the former question, that by a duplex-pump, I mean two separate double-acting-pumps; only one pump is shown in model, Exhibit No. 35, I. H. B., and a great number of the pipes are not shown on the model, they are so apparently complex in their arrangement.

Cross-int. 190. Did you continue to use these stills, in the manner you have described, until your refinery was destroyed by fire in 1870?

327 Ans. That was the practice. In evaporating down some kinds of oil, it was unnecessary to run the oil through the whole series. We would use one, two, or three stills simultaneously, doing the same work.

Cross-int. 191. The paraffine oil distilled over from the second still,

or from the second and third, when three were used, was the oil you have spoken of to-day as neutral topaz oil, with the paraffine in it, was it not?

Ans. It was.

Cross-int. 192. Can you state at about what temperatures you used the steam and superheated steam in the several stills, in the process you have described?

Ans. I cannot. We used our common steam from one hundred and fifty to two hundred pounds pressure; the heat of our superheated steam I do not know.

Cross-int. 193. Have you not any idea as to the temperature it was?

Ans. The pipes have a red heat, which the steam passes through, and which lead to the still. Sometimes they have a low red heat when passing into the still; I don't know what the temperature of the steam was.

Cross-int. 194. Do you mean that the pipes sometimes had a low red heat, where the steam entered the still?

Ans. I do.

Cross-int. 195. Were they heated to that temperature at that point by the steam passing through?

Ans. They were.

Cross-int. 196. Can you state generally the length and diameter of the pipes in the furnace where the steam receives its heat? I mean in the superheater?

Ans. I cannot.

Cross int. 197. Can't you give me a general idea?

Ans. I will furnish you with photographs of those I used, and exact drawings.

Cross int. 198. State as nearly as you can.

Ans. About sixteen feet long, each. From fourteen to twenty-five of these pipes are about the number I used in my furnace. The pipes in my superheating furnace were sometimes out of order, and had
328 to be changed and replaced, or altered, so that the number of pipes in my furnace varied at different times. The interior diameter of my superheating pipes varied from one to eight inches.

Cross-int. 199. Can you state what was the diameter of the pipes shown on the photograph of your works, Exhibit No. 70, I. H. B.?

Ans. Four and a half inches, interior diameter of the arches. Outside diameter, about six. By arches, I mean a section of the pipe.

Cross-int. 200. In your answer to the 183d cross-interrogatory, you speak of selling the Lightfoot Company large quantities of a green residuum oil of distillation; when did you commence making sales to that company, and how long did you continue to sell to them?

Ans. I think I commenced in the fall of 1868, and continued selling to them for probably a year. I forget.

Cross-int. 201. Did you sell them any other kind of oil? If so, what?

Ans. I don't think I did.

Cross-int. 202. Did you sell to tanners or curriers, during the fall of 1868, this heavy green oil, or any other kind of oil?

Ans. I presume I did.

Cross-int. 203. What were the other kinds you sold?

Ans. Illuminating oil, amber oil, amber machinery-oil, spindle, locomotive, railroad-axle, neutral topaz, tanners', head-light, and wool-oils. I presume I sold all of these.

Cross-int. 204. Did you sell them with the understanding that they were to be used upon leather in the process of finishing it?

Ans. I sold the tanners' oil, and I presume it was used in currying. I know nothing positively as to what became of it.

Cross-int. 205. Did you sell any neutral topaz oil, as you now call it, to be used in the process of finishing leather?

Ans. I do not remember.

Cross-int. 206. Did you advertise your oils during the fall of 1868 especially for curriers' use?

Ans. I cannot remember. I think that I did have some neutral topaz oil, with the paraffine in, tried at one or two tanneries in the city.

Cross-int. 207. At what tanneries?

Ans. I think one was Hartley's tannery; and the other, I think, was Callery's. I cannot give the first name in either case.

329 Cross-int. 208. Do you recollect whether or not you prepared any circulars and distributed them among the tanners and curriers, setting forth the merits of your oils for their purposes?

Ans. I believe there were some circulars issued at the suggestion of the Lightfoot Company in regard to tanners' oil.

Cross-int. 209. Are you sure that it was at the suggestion of that company?

Ans. If I remember right, a sort of verbal agreement was entered into between the Lightfoot Company and myself in regard to the tanners' oil. I really forget what the nature of that agreement was.

Cross-int. 210. Was this oil which you call tanners' oil the heavy green oil you have mentioned, and which you sold to the Lightfoot Company?

Ans. It was a heavy green oil, twenty-five, twenty-six, or twenty-seven gravity, from which the paraffine oil had been more or less abstracted.

Cross-int. 211. Did your agreement have reference to any other oil to be used for tanners' or curriers' purposes?

Ans. I really forget, but have an indistinct remembrance that it embraced light-colored paraffine oil in the Lightfoot patents.

Cross-int. 212. Do you recollect whether that agreement, if there was one, contemplated your furnishing the company with light-colored oils, or the company furnishing you with light-colored oils, for tanners' use?

Ans. I do not remember.

Cross-int. 213. Do you remember having any talk with any of the officers or agents of that company about their furnishing you with light-colored oils for tanners' use?

Ans. I do not.

Cross-int. 214. Can you say that there was no such talk?

Ans. I cannot.

Cross-int. 215. Was there not some negotiation between you and Mr. Wynn, the president of the Lightfoot Company, or with some of its other officers or agents, about their supplying you with light-colored oils made by Seccomb, Kehew and Thayer?

330 Ans. I do not now recollect any negotiations on that subject having taken place. I remember Mr. Seccomb or Mr. Thayer sending me a sample of their Lightfoot's finishing-oil, I think they called it, and a lot of samples of leather. That is about all I remember upon that subject.

Cross-int. 216. When did they send you that sample of oil, and about how much was there of it?

Ans. I forget the time. It was a small vial; perhaps there were two vials; I forget.

Cross-int. 217. Was it in the fall of 1868?

Ans. I do not remember.

Cross-int. 218. Did they not send you a whole barrel of their oil?

Ans. They may have done so, but I do not think they did.

Cross-int. 219. Are you able to say positively that there were not negotiations in the fall of 1868 with Mr. Wynn or with other officers or agents of the company, in relation to the Lightfoot Company furnishing you with light-colored oils for sale through the West for tanners' and curriers' use?

Ans. Mr. Wynn, or other officers of the company, may have desired to sell me some of their products; but I am very sure I never solicited or purchased any, for this reason: I knew that there was a lot of this oil referred to (marked, I think, "Lightfoot's currying oil") in this market which was unsalable. It had been here for some time, and, as I understood it, could not be sold or used. I think it was in the possession of Mr. Decamp of this city, formerly a sort of agent for the Lightfoot Company.

Cross-int. 220. To go back to the matter of circulars, you say, in answer to cross-interrogatory 208, that there were some circulars issued at the suggestion of the Lightfoot Company in regard to tanners' oil. Who prepared those circulars and procured them to be printed?

Ans. They were prepared, I think, after a circular sent me by the Lightfoot Company. I presume I prepared them, or had them prepared and printed.

Cross-int. 221. Will you look at the papers now shown you, marked "Exhibits Nos. 78 and 79, I. H. B.," and state whether you prepared, or procured those circulars to be prepared, and procured them to be printed?

Ans. I prepared these circulars, or had them prepared after circulars of similar kind sent to me by the Lightfoot Company, and had
331 them printed. In regard to these circulars, I remember Seccomb, Kehew and Thayer manufactured a fine article of paraffine oil. They were anxious, I think, to sell their oil through the Lightfoot Company, and they called it A A X; and another kind they called A X; and, also, I think Mr. Wynn manufactured an oil of some kind or other, and he wanted to sell under the Lightfoot patents. They had their axes to grind; I was content to sell them the stuffing oil, although I was making a superior oil for finishing leather at the same time.

Cross-int. 222. What was that superior oil?

Ans. Neutral topaz oil, with the paraffine in.

Cross-int. 223. And did you make any effort to sell that oil to the Lightfoot Company, or offer to sell it to them, or to supply it to tanners and curriers on their account?

Ans. I did not offer to sell it to the Lightfoot Company, or I would have interfered with Messrs. Seccomb, Kehew and Thayer, who were selling their paraffine oils to the Lightfoot Company, I think, and Messrs. Seccomb, Kehew and Thayer were the agents in Boston of the Lightfoot Company. They exerted their influence in my favor with the Lightfoot Company, and of course it was not my interest to lose their friendship by interfering in their trade.

Cross-int. 224. Did you show this superior oil to any of the officers or agents of the Lightfoot Company, or to Messrs. Seccomb, Kehew and Thayer?

Ans. I don't know that I did.

Cross-int. 225. Did you not send or carry them samples?

Ans. I do not remember whether I did or not.

Cross-int. 226. Do you remember to what extent you circulated these

circulars, which have been produced, among the tanners and curriers of the West?

Ans. I presume several hundred were circulated.

Cross-int. 227. The circular marked "Exhibit No. 78, I. H. B.," commences as follows: "Herbert W. C. Tweddle, sole manufacturer of Lightfoot's currying and harness oils, under patents owned by the Lightfoot's Currying Oil Co. and himself;" and it mentions three kinds of oils: "vacuum oil is a heavy black oil, an excellent article for stuffing; A A X oil for finishing; A X oil for oiling off." What kind of oils were these oils, A A X and A X; what was their appearance and their gravity?

332 Ans. The gravity of the dark-green stuffing oil was from twenty-five to twenty-seven gravity; it was dark green in color. The A A X and the A X were paraffine oil, or neutral topaz oil, with the paraffine in, were about thirty-four gravity, and, as far as I remember, were one and the same thing. I think that the users of this oil were told to mix whale oil or something with it. The green stuffing oil was what remained after the illuminating oils and the paraffine oils were distilled off. The A A X oil and the A X oil were paraffine oil, distilled off to obtain the green stuffing oil; on the amount taken off depended the gravity of the heavy green stuffing oil.

Cross-int. 228. Do you remember at what prices you sold these oils in the fall of 1868?

Ans. I think the price of stuffing oil was from thirty to forty cents; of the others, seventy to eighty cents.

Cross-int. 229. Can you name any parties to whom you sold the A A X oil and the A X oil in the fall of 1868?

Ans. I cannot remember any parties. Very little of it was sold. In fact, very little of these oils were sold to any one but the Lightfoot Company. The circulars, as far as I remember, were sown on barren ground. The tanners in the West had a prejudice against the oils.

Cross-int. 230. Do you remember about what time the circular marked "Exhibit No. 78, I. H. B.," was printed?

Ans. The circulars were both printed in September, 1868.

Cross-int. 231. Was it true, as stated in the circular Exhibit No. 78, I. H. B., that you were the sole manufacturer of Lightfoot's currying and harness oils?

Ans. As far as I know, I was the sole manufacturer of the stuffing oil. I do not know whether I was sole manufacturer of the A A X and the A X oils.

Cross-int. 232. Don't you know that Seccomb, Kehew and Thayer were manufacturing those finishing oils at the same time, and have you not just stated that the reason for your not offering those oils to the Lightfoot Company was because you did not wish to interfere with Seccomb, Kehew and Thayer?

Ans. I did know that they were manufacturing those oils, nor
333 did my offering those oils for sale interfere in any way with Seccomb, Kehew and Thayer's sales to the Lightfoot Company, for this reason: The Lightfoot Company had divided the territory of the United States into several sections. Most of the Southern States, and I think Illinois and Missouri, belonged to a gentleman whose name I now forget. The Lightfoot Company were to let me sell in all the Western States, but I was not to interfere in New England or New York, so that I was virtually the sole manufacturer for all the Western States and Pennsylvania, except the States held by the gentleman whose name

I forget. I do not think the Lightfoot Company, or Seccomb, Kehew and Thayer, ever took any exception to those circulars.

Cross-int. 233. Was it at the suggestion of the Lightfoot Company that you represented yourself as the sole manufacturer of the Lightfoot's currying and harness oil under patents owned by Lightfoot's Currying Oil Company and yourself?

Ans. I have no doubt but that I received their permission for doing so.

Cross-int. 233*a*. From whom?

Ans. I presume I received permission from the company. If not, I had their tacit acquiescence.

Cross-int. 234. Through what officer or agent of the company did you obtain such permission?

Ans. I should think from Mr Wynn, who, I believe, sent me the circulars to copy from, or from some of the other members of the company. I attended a meeting in Philadelphia, of the Lightfoot people, composed mostly of Quakers. Perhaps I received permission from them.

Adjourned to meet at the same place, at 3.45 p. m.

3.45 .P M.

Met pursuant to adjournment. Present, as in morning.

Cross-examination resumed:

Cross-int. 235. In the circular marked "Exhibit No. 79, I. H. B.," I find this statement: "I am prepared to supply my superior and improved paraffine oils, for currying leather, manufactured in vacuum by
334 steam, under the patents granted to myself." What oil is referred to under the term "paraffine oils," in that statement?

Ans. I presume it refers to the heavy green oil for stuffing, and includes the A A X and the A X oil.

Cross-int. 236. Mr. Toppan, the agent of the Lightfoot Company, called on you in the early part of August, 1868, did he not?

Ans. He called on me during 1868. I don't know at what time.

Cross-int. 237. Had you any knowledge of or dealings with the Lightfoot Company before he called on you?

Ans. I think not. Mr. Toppan is the gentleman whose name I wanted to remember this morning, as owning some of the Southern and Western territory under the Lightfoot patents.

Cross-int. 238. He visited your refinery at Sharpsburg bridge, did he not?

Ans. He called at my office at the Sharpsburg bridge.

Cross-int. 239. Did he give any reason for coming to see you, or state any object he had in view in coming?

Ans. I was absent from home when he called.

Cross-int. 240. Well, I am speaking of a time when you were at home, and when he did see you.

Ans. He never called to see me at the Sharpsburg bridge, when I was at home, that I am aware of. I saw him at a hotel in this city.

Cross-int. 241. State what passed between you at your first interview.

Ans. I think he wanted to see if I would manufacture a currying-oil for the Lightfoot Company. He gave me a sample of oil, if I remember right, or he left a sample at my house on his first visit, for me to examine.

Cross-int. 242. What kind of oil was the sample he left with you?

Ans. It was a dark green, viscid oil, as near as I can remember.

Cross-int. 243. Did you see him more than once, that time he was in Pittsburgh, that you remember?

Ans. I forget whether I did or not.

Cross-int. 244. Did he show you more than one sample of oil, that is, samples of different kinds of oils, which he wanted?

Ans. He may, and he may not. I forget, but do not think he did.

Cross int. 245. Did you keep the sample or samples which he showed you, or any part thereof?

335 Ans. I presume I did keep them for some time.

Cross-int. 246. Did you show him samples of the various kinds of oil which you were manufacturing?

Ans. On his first visit my men were not satisfied as to his intentions, and I do not think gave him much satisfaction. When I saw him on his second visit I forget whether I exhibited any samples or not.

Cross-int. 247. What do you mean by his second visit?

Ans. I was absent on his first visit. On his second visit I saw him at the Union Depot Hotel.

Cross-int. 248. Do you refer to the same interview at which he showed you a sample or samples of the oil he wanted?

Ans. I do not. He left a sample at my house or office, on his first visit.

Cross-int. 249. When you speak of first and second visits, do you refer to first and second visits to Pittsburgh, or to his visits at your works, when, you say, he did not see you, and to a subsequent interview at the Union Depot Hotel, during the same visit of Toppan at Pittsburgh?

Ans. I cannot understand the question. What I mean by his first visit, was when he called at my works during my absence from the city. When I refer to his second visit, I mean when he visited Pittsburgh subsequently, and when I had an interview with him at the Union Depot Hotel.

Cross-int. 250. Now, did you furnish him at any time, while he was in Pittsburgh, during what you call his subsequent visit, with samples of the various kinds of oils you were manufacturing?

Ans. I forget whether I did or not.

Cross-int. 251. Did you show him samples of such oil?

Ans. I forget whether I did or not.

Cross-int. 252. Did you at any time after that show him or furnish him with samples of such oils?

Ans. When you refer to "such oils," do you mean some specific oils?

Mr. SMITH replies: I mean the various oils you were manufacturing in 1868, or at the times of his visits.

Ans. I do not remember whether I did or not.

Cross-int. 253. Will you look at the letter marked "Exhibit No. 80, I. H. B.," and state whether you wrote it?

336 Ans. I wrote this letter.

Cross-int. 254. This letter was written subsequent to Mr. Toppan's visit to you, was it not?

Ans. It must have been to his first visit to me.

Cross-int. 255. You say in the letter that "within a few days I will forward to Mr. Bartlett some light-colored oil, which I think will be admirably adapted to the purposes of the Lightfoot Company. He will submit it to your inspection, and if it suits I will manufacture it in any quantity that you desire;" what kind of oil was that?

Ans. Neutral topaz oil, from which the paraffine had not been abstracted.

Cross-int. 256. Was it the same kind of oil as that you spoke of a

little while ago, as being better than the oil manufactured by Seccomb, Kehew and Thayer?

Ans. On perusing this letter for the first time, I think it may not, perhaps, refer to neutral topaz oil, from which the paraffine had not been abstracted. It might be light-colored amber oil, or it might be the last run of the paraffine distillate, or from the first run of paraffine distillate. I cannot positively state what the samples were.

Cross-int. 257. The printed matter on this exhibit was a business circular, or advertisement, that you were using at that time, was it not?

Ans. It was.

Cross-int. 258. Did you have any interviews with Mr. Toppan, subsequently to the time that that letter was written?

Ans. I think I had, once in the East, and once here in Pittsburgh; I may have had more, that I cannot now remember.

Cross-int. 259. When was the visit here in Pittsburgh?

Ans. I think it must have been in 1869 or 1870; but am not very sure about it.

Cross-int. 260. What passed between you at that time?

Ans. If I remember right, he told me he had a patent for filtering heavy oil, and talked about buying some thousands of barrels. Think he said that he had the control or management of the Lightfoot Company.

Cross-int. 261. What kinds of oils are those referred to on the bottom of the second page of your letter marked "Exhibit No. 80, I. H. B.?"

337 Ans. I should say dark green oils, from twenty-five to twenty-seven gravity.

Cross-int. 262. Will you look at the letter marked "Exhibit No. 81, I. H. B.," and state whether you wrote it?

Ans. I did.

Cross-int. 263. Have you read the whole letter?

Ans. I have glanced it over.

Cross-int. 264. Will you read it carefully?

Ans. I have done so.

Cross-int. 265. You speak in this letter of Rochester Company; what company was that?

Ans. It was a company styled the Vacuum Oil Company of Rochester, New York; of which a man named Everest, I believe, was president.

Cross-int. 266. What kind of oil was that company manufacturing at that time?

Ans. I never saw any of the oil manufactured by that company except an oil put up in small tins, holding about a pint or a quart, and called harness oil.

Cross-int. 267. Describe that oil.

Ans. It was a dark green oil, about the consistency of castor oil. I think the sample which was brought to my notice was mixed with some animal or vegetable oil.

Cross-int. 268. Don't you know now, and didn't you know at the time you wrote this letter, that that company was engaged in manufacturing and selling largely a stuffing oil for the use of tanners and curriers?

Ans. I knew that they were putting up this oil in tins. I went to Rochester, I think in the fall of 1868, soon after it came to my knowledge that they were manufacturing oil by superheated steam in vaccum, and notified them personally that they were infringing my patents, and I should prosecute them if they did not stop or come to some understanding with me. They could not be manufacturing largely, for they had such a small apparatus that it was impossible for them to do so.

Cross-int. 269. They were manufacturing and selling, were they not, a stuffing oil for the use of tanners and curriers, whether largely or not?

338 Ans. I do not know positively whether they were selling anything else than that they put up in cans.

Cross-int. 270. You say in your letter, "I only regret that I have not some certificates, such as the Rochester Company attach to their circulars." What was the nature of those certificates?

Ans. I do not remember.

Cross-int. 271. Didn't they contain recommendations of the Rochester oil for use of tanners and curriers, and certificates for such uses?

(The counsel for defendants object to this question as incompetent.)

Ans. The presumption is, from my letter, Exhibit No. 87, that I must have seen or heard of some such circular. But I do not remember anything about it.

Cross-int. 272. You don't remember what made you regret that you had not got some such certificates for your circular, do you?

Ans. I do not.

Cross-int. 273. On the second page of the letter you say, "I have made a considerable improvement within the past few days in making the tanners' oil." Do you remember what the nature of that improvement was?

Ans. I think it refers to this: The Lightfoot Company wanted an oil which was viscid, without being too dark in color, and wanted the paraffine more thoroughly out of the oil.

Cross-int. 274. Will you look at the letter marked "Exhibit No. 82, I. H. B.," and state whether you wrote it or not?

Ans. I wrote this letter.

Cross-int. 275. To whom did you make your first sales or your early sales of paraffine, when you commenced selling?

Ans. I made several small sales in 1870. The first large sale that I remember was to Mr. Kendrick, of Philadelphia. I do not remember his first name, but he is the only lubricating-oil man of that name that I know of in Philadelphia. His place of business is on Walnut street, below the Exchange building. I think he is I. M. Kendrick, dealer in lubricating oil.

Cross-int. 276. Was this scale paraffine or refined paraffine wax?

Ans. It was a car load, some six or eight tons, of refined paraffine wax, of low melting point. This was a short time before my works burned down, in June, 1870.

339 Cross-int. 277. To whom did you make the small sales you have referred to?

Ans. Husband Brothers, of St. Louis, got some. The name of other parties I do not remember.

Cross-int. 278. Was any of your paraffine sold, or offered for sale, in New York before your works burned down?

Ans. It was.

Cross-int. 279. Will you state to whom it was sold, or in whose hands it was offered for sale?

Ans. I offered forty or fifty tons in the fall of 1869, through the Manhattan Oil Company of New York, and I offered some to or through Colgate and Company, of New York, and through J. R. Bartlett, of Boston, Massachusetts.

Cross-int. 280. In your patent of February 15, 1870, No. 99,975, I find this passage: "After being thus purified, such oils" (meaning, as I understand it, the oils before known, referred to in the previous passage,)

"are used as lubricants, but they are very deficient in body, and contain animal or vegetable oils, which compounds assume to a great extent the blue and green tint above referred to, which in commerce is objectionable; and paraffine oils thus made do not command a ready sale for the above reasons." What do you mean by saying that such oils contain animal or vegetable oils?

Ans. I mean to refer to the compounds of paraffine and animal or vegetable oils.

Cross-int. 281. You speak several times in the patent of the blue and green tint of the paraffine oil as being objectionable in commerce; why are they objectionable?

Ans. Dealers in lubricating oils, who compound paraffine and vegetable or animal oils, do not like the presence of paraffine oil to be exhibited in the compound, and a blue or green tint given to the compound betrays their presence.

Cross-int. 282. You speak in the patent referred to of distilling by means of vacuum, steam, or superheated steam, and you say that in connection therewith a moderate fire-heat may be applied to the outside of the still in any of the ways known to the art. Do you use such outside heat in your manufacture of neutral topaz oil?

340 Ans. I have used outside heat in the manufacture of neutral topaz oil when my superheaters are out of order.

Cross-int. 283. Did you make such use of fire at the Eclipse Works at Sharpsburg bridge?

Ans. I have at times when my superheaters were out of order, and have also used outside fire-heat in experiments which I was conducting.

Cross-int. 284. To which of your stills at the Sharpsburg bridge did you make such application of outside heat?

Ans. Under stills No. 1 and 2, like Exhibit No. 35. I call the top one number one; and also under my large still in manufacturing a new oil, which has not yet been put on the market.

Cross-int. 285. To apply fire-heat to the stills, numbers one and two, represented by Exhibit No. 35, you had to have a furnace of some kind under the stills, did you not?

Ans. I had not.

Cross-int. 286. How did you apply the fire-heat to those stills?

Ans. I had a small three-eighths of an inch pipe, perforated, through which I introduced benzole. This was only done when I was making experiments, or when my superheaters gave out, to prevent the stoppage of my works.

Cross-int. 287. These pipes are not represented in the Exhibit No. 35, are they?

Ans. They are not.

Cross-int. 288. Where were they placed in your working-stills?

Ans. About six feet below the bottom of the still, at the front.

Cross-int. 289. When were they first applied to stills?

Ans. The first time, I think, they were ever applied was in the winter or spring of 1869.

Cross-int. 290. When were Exhibits Nos. 54, 55, and 56 made?

Ans. They were made at Aladdin, a day or two before they were produced as exhibits.

Adjourned till to-morrow at 10 a. m., at the same place.

341 JUNE 14TH, 1871.

Met at time and place fixed by and pursuant to adjournment.

Present, Mr. Smith, of counsel for complainants, and Mr. Bakewell, of counsel for respondents, and Mr. Merrill.

Cross-examination resumed:

Cross-int. 291. I think you spoke of putting up stills for the Aladdin Co. in 1868 like those represented by model Exhibit 35. Who were the proprietors of those works at the time the stills were put up?

Ans. Brereton & Wilkins.

Cross-int. 292. Did those parties pay you anything, or agree to pay you anything, as a patentee, either as the price of the stills or as a royalty upon the oil that should be manufactured?

Ans. They agreed to pay me a royalty, and to pay me a small bonus to erect the apparatus.

Cross-int. 293. What royalty did they agree to pay you?

Ans. It is so long since that I really forget; I think the agreement was destroyed by fire when one of my houses was burned. They had a copy of the agreement, I think.

Cross-int. 294. Can't you state about what it was?

Ans. I cannot.

Cross-int. 295. Did you ever put up stills like Exhibit 35 at any other time for any other parties?

Ans. I never did.

Cross-int. 296. Did you have negotiations with any other parties with reference to putting up stills of this kind?

(Objected to, on account of irrelevancy of the question to the matter at issue between the parties to this suit.)

Ans. I decline to answer.

Cross-int. 297. Why do you decline to answer the last question, after your counsel has said to you that his objection was not intended for you to act upon?

Ans. My counsel signified an objection, and I regard his apparent wish as a command.

(The counsel for defendant says he has no objection to the witness
342 answering the question. The witness now answers in response to cross-interrogatory 296.)

I did talk to several parties on the subject; among the rest Messrs. Lockhart & Frew; Rockfellow & Andrews, of Cleveland, O.; the Oleophine Oil Co. of New York; perhaps I have even spoken to the firm or company of the Downer Kerosene Oil Co., as I have talked, no doubt, to others.

Cross-int. 298. In your answer to interrogatory 173, direct examination, you say you called at the office of the Downer Kerosene Oil Co., in the city of New York, and saw a gentleman whom you think was Mr. Green. Can you fix the time more definitely when you made that visit? Please look at your answers to interrogatory referred to before you answer this.

Ans. I cannot fix the time definitely; think it was in the warm weather. The reason I cannot do so is because I am in the habit of going to New York and Philadelphia very frequently.

Cross-int. 299. Are you sure that visit was made in 1868?

Ans. In my former examination, some months ago, I had traced over in my memory the past few years more carefully than I have done on this cross-examination, and have no doubt the year is correct.

Cross-int. 300. In your answer to direct interrogatory 176, you speak of a visit which Mr. Downer made to your office in 1868, after the month of May. Will you please look at the whole answer, and reflect, and see if you cannot fix the time more definitely?

Ans. I cannot.

Cross-int. 301. Will you describe a little more fully the presses which

you first erected for expressing oil from paraffine with which you used hydraulic jacks?

Ans. They were wooden presses braced with iron; there were four upright posts as guide-posts, to each press; the press-boards were of wood; they had long wooden levers to them, each lever about twenty-five feet long, about twenty inches deep, and twelve inches broad; we used these levers for some time themselves to get the requisite pressure; we found that the pressure obtainable by them was insufficient; we then strung the beams up near the floor of the warehouse and used hydraulic jacks; these jacks, about which you made such a close previous
343 inquiry, were borrowed from Messrs. Lockhart & Frew; the carpenter, Mr. George, who constructed the presses, lives at Sharpsburg. There were only two presses made in this way; the other six presses had no levers, but we used hydraulic jacks with them altogether; the first two presses alluded to held from twelve to eighteen barrels each; the others held from eighteen to thirty-five barrels each.

Cross-int. 302. There was a movable platform or platen, I suppose, within these guide-posts, which was guided by the posts?

Ans. There was no platen; we used, instead of a platen, blocks of oak wood, between four and five feet long, each six inches square. When the presses were filled with the frozen paraffine oil in bags, we tiered these blocks of wood, two, three, or four deep, filling the entire space on the top boards; we then placed the hydraulic jack on the top of this temporary platen, and used the pressure obtainable by its operation, which was some twelve or fifteen tons, perhaps twenty tons, to force down the platen and express the oil. The presses were about fourteen or fifteen feet high, and as we pressed down the platen, and the jack ran out, we moved the jack lower down, and re-exerted the pressure until the operation was finished.

Cross-int. 303. What was the size of the press-boards?

Ans. As near as I remember, about five feet long and about three feet wide.

Cross-int. 304. What was the diameter of the cylinder of the hydraulic press which you subsequently constructed, or had constructed?

Ans. The ram or piston which worked in the cylinder was, I think, about twelve or thirteen inches in diameter.

Cross-int. 305. Where was this press constructed?

Ans. Messrs. Dickson & Marshall made the cylinder, the ram, the collar, and the upper and lower platen. Mr. Fisher bored out the cylinder and the collar. I made the stretchers, rebuilt some old pumps which I purchased, rebuilt an old engine, and did all the rest of the work to finish the press in my machine-shop at my works.

Cross-int. 306. Give the places of business of the gentlemen you have named.

Ans. Dickson, Marshall & Co.'s foundry and office are on Liberty street, near the outer depot, Pittsburg; Mr. Fisher has a machine-shop near Hussey's Steel-Works, 17th street, Pittsburgh.

344 Cross-int. 307. In your answer to direct int. 71 you describe the method you pursued in distilling some crude petroleum from Barren Co., Ky.; your first step was to treat it in an agitator with sulphuric acid. Can you state about what quantity per barrel of petroleum you used of sulphuric acid?

Ans. I cannot.

Cross-int. 308. Can't you state approximately?

Ans. The reason that it is not possible for me to state approximately

is that I used sulphuric acid in such quantities as I thought sufficient to accomplish the purpose in view.

Cross-int. 309. You have no recollection now as to what that quantity was, I understand?

Ans. I have not, nor do I distinctly recollect what was the minutiæ of the chemical treatment. I only know I did it.

Cross-int. 310. Can you state what the appearance of the petroleum was after you had treated it with acid in the agitator?

Ans. I cannot, for this reason: since 1863 I have very seldom gone into an agitating-room, or into any place where sulphurous-acid gas was evolved, as I suffered for some years from a bronchial complaint; the gas was so irritating to my throat that I had to avoid such places, and had such operations as the one in question carried out by instructing others.

Cross-int. 311. Can you state how much alkali you used in the next step, as you described it, and how you applied the alkali to the oil?

Ans. I cannot name the quantity of alkali; presume sufficient was used to neutralize any remaining acid. It was caustic akali in a very strong solution, I think. The oil was taken from one agitating-tank where it had been treated with the acid (perhaps with other chemicals) and put in a clean agitator; the solution of alkali was poured in and agitated very vigorously with it for a long time. I may here mention that in the first chemical process a large amount of carbon was precipitated, and had to be dug out of the agitator with pick and shovel.

Cross-int. 312. Can you tell about what percentage of carbon was precipitated?

Ans. I cannot, nor have I the most remote idea.

Cross-int. 313. Was the alkali readily separated from the oil?

Ans. I do not remember.

345 Cross-int. 314. Was there any alkali present in the still during the process of distillation?

Ans. I have no doubt but that there was.

Cross-int. 315. In the distillation, what percentage of the original crude petroleum did you obtain as a distillate, and what as a residuum?

Ans. I do not remember.

Cross-int. 316. What was the color and density of the distillate?

Ans. I do not remember. I have lost by fire all my memoranda regarding it.

Cross-int. 317. Can you give the amount of acid and alkali which you used in the treatment of the distillate after the first distillation?

Ans. I cannot.

Cross-int. 318. Can you give the percentages compared with the crude petroleum of the distillate and residuum of the second distillation?

Ans. I cannot. All I remember is this: that when I found the still running yellow, and spoiling the distillate already made, I told the distiller, or the foreman, to have the operation stopped. They showed me a sample of the residuum in the still. I found that the crude oil would give a very great deal of trouble and expense in the works to use it, and I abandoned it as not being useful for our purposes, and thought no more about the matter. The residuum in the still was yellow after the second distillation, and had very little odor.

Cross-int. 319. Will you look at the three notices contained on the slip marked "Exhibit No. 83," and state whether or not they were published in the Boston papers in the spring of 1870 by your direction or with your sanction?

Ans. The notices in question I never saw before I saw them published in the Boston papers. I told Mr. Bartlett, my agent, that if the Downer Kerosene Co. did not stop threatening and intimidating my customers, to take some steps by publishing a protest against the manner in which they were acting. He, I presume, wrote these notices and caused them to be published.

Cross-int. 320. Have you examined the old still at your old Eclipse Works, at Sharpsburg bridge, and ascertained the particulars concerning it, about which I made inquiry in the early part of the cross-examination?

346 Ans. I went out early this morning, and examined it myself with another gentleman, who made a rough sketch, and took notes of its interior and exterior construction. I found it very much damaged in the exterior; the cocks and pipes and bricks being melted off and down by the fire which destroyed my works the 28th of June last year. I found it was built in strict accordance with the lower still exhibited in model 35. The description of the size, number of pipes, etc., were about exact with the description I gave of it previously during this cross-examination. I have not been in the still since I constructed it in 1866 and 1867, and I will be happy to give you written permission to go and examine the still at any time during the day.

Cross-int. 321. Do you remember telling your counsel, Mr. Browne, and myself, yesterday, that it would cost a hundred dollars to make such an examination of the still as would enable you to give the information which I desired?

Ans. I do.

Cross-int. 322. Have you spent a hundred dollars there this morning?

Ans. I have not. I spent six dollars this morning. I found that the still was easier of access than I supposed, and I thought yesterday that Mr. Smith wanted an analytical examination of the still made; i. e. take it down to examine it piecemeal to see that the steam-pipes are constructed as they are in the model; to do so will take a hundred dollars, perhaps more.

Cross-int. 323. What made you think I wanted an examination of that kind made?

Ans. I had that impression.

Cross-int. 324. Why did you decline yesterday to allow Mr. Merrill, the plaintiff, to examine the still?

(Counsel for respondents objects to the question, inasmuch as the witness stated to the counsel for complainant that he would consider the matter, and consult with his counsel, and inform Mr. Smith afterwards whether or not such permission would be accorded, which permission has been granted of record this morning.

Counsel for complainant says that what is stated above by the counsel for respondents took place after the adjournment last evening; that he refers to a conversation in the morning when he first suggested

347 that Mr. Merrill should go out and examine the works and when he understood him to refuse absolutely, Mr. Bakewell, the only counsel for respondents now present, not being then there.

The witness asked to be allowed to see the record where he refused to let Mr. Merrill go to the works.

Mr. Smith replies to the request that the conversation referred to was not of record.)

Ans. Since the commencement of this suit, and since the fire in June last, I have scrupulously, as far as was in my power, guarded against

any one, even myself, tampering with or altering the interior of that still; and I would not permit Mr. Merrill, or any one else, to examine that still, except in the presence of witnesses, and that in the day-time; and although I am willing to accord Mr. Merrill permission to go and see and look at the interior of the still, he must do so in the presence of witnesses whom I will appoint and send with him.

Cross-int. 325. Did you find the still this morning, particularly as to its pipes, in the condition in which you described it to be in the early part of your cross-examination?

Ans. I did.

Cross-int. 326. Are the pipes all in it which were in it when you used the still in 1867, 1868, and onwards?

Ans. They are all in it. I think that one or two of the lower horizontal steam-pipes were split about the winter of 1868, and perhaps the holes in the casting would be plugged; by casting I mean the steam-box; that, I think, would be the only variation.

Cross-int. 327. In your answer to cross-interrogatory 67, you say that there were from one hundred twenty to one hundred fifty horizontal steam-pipes in still; "I should say about that number." Did you find that number there this morning?

Ans. I think that there are about one hundred and twenty-six horizontal pipes; some few of the holes may be plugged up.

Cross-int. 328. What is the diameter and length of those pipes?

Ans. Their interior diameter is two inches; their exterior about two and a half inches. The length of the pipes vary from about six to seven feet each; some may be a little shorter or a little longer.

Cross-int. 329. Do you now refer to the pipes over which the oil
348 trickled in the process of distillation, or to those which introduced and discharged the steam into the body of the still?

Ans. I refer to those pipes over which the oil trickled.

Cross-int. 330. How many did you find, one above the other, in each series?

Ans. I think there were seven.

Cross-int. 331. How many series of this kind did you find?

Ans. I think there were eighteen.

Cross-int. 332. Occupying the whole body of the still?

Ans. Nearly the whole body of the still.

Cross-int. 333. Are the troughs there through which the oil was distributed over the pipes?

Ans. A few of the troughs were missing.

Cross-int. 334. How high above the bottom of the still at the centre are the troughs which are still there?

Ans. I should say about three feet six or eight inches.

Cross-int. 335. How high above the upper steam-pipe of a vertical series of pipes is the trough placed which supplies those pipes?

Ans. I should say an inch or so. I did not take any exact measurements.

Cross-int. 336. Did you ascertain whether the dimensions which you gave of the body of the still, in the early part of the cross-examination, were substantially correct?

Ans. They were, in the main, correct. The inside diameter was a little less. I think I said before it was ten and a half feet; it was only ten feet.

Cross-int. 337. If I have understood you correctly, you continued to use this still for distilling oil down to the time or near the time when your refinery was destroyed?

Ans. We used it up to within a few months, anyhow, of the time when my refinery was destroyed by fire.

Cross-int. 338. Did you make use of the still during those few months preceding the destruction of your refinery?

Ans. Only to hold oil.

Cross-int. 339. About how many months did you use it for that purpose?

Ans. Perhaps two or three months.

349 Cross-int. 340. Have you ascertained whether the articles from the Pittsburgh Commercial, to which your attention was directed at an earlier stage of the cross-examination, were published at the dates on the slip, and whether you paid for their insertion?

Ans. I have not yet, not having been afforded an opportunity to do so. I will do so. I never paid one cent in my life to have any articles published in a newspaper flattering either myself or giving flattering descriptions of my works or my process. I have always paid for my advertisements, but never for any other article, that I remember.

Cross-int. 341. Do your last observations as to what you have never done apply to the articles in question?

Ans. They do, to the best of my recollection and belief.

Cross-int. 342. I must request you to make inquiries at the office of the paper in question and ascertain, before our next meeting, whether you did pay for the insertion of those articles or not, and what were the dates of those insertions.

Ans. I will do so, and try to obtain duplicate bills of the advertisements in question.

Adjourned till to-morrow morning as 10 o'clock.

JUNE 15TH, 1871.

Met at same place, pursuant to adjournment.

Present, counsel of the respective parties, and also Mr. Merrill.

Cross-examination resumed:

Cross-int. 343. Have you made the inquiries at the Commercial office referred to in the last question?

Ans. I have, and they said that the book-keeper was absent, and that they could not give the information regarding payment for advertisements in question which I desired. Probably when he has leisure he will do so.

Cross-int. 344. Mr. Merrill visited your still at Sharpsburg yesterday, as you are aware, and observed a pipe lying near the still in question, which he supposes to be the cylinder shown in the photograph Exhibit No. 70, I. H. B., marked "A 1." Was that so?

Ans. It was.

350 Cross-int. 345. Do you remember the dimensions of that pipe?

Ans. I think it is two feet interior diameter and eight feet long.

Cross-int. 346. The oil-vapors from the still passed off through this pipe, did they not?

Ans. They passed up that pipe on their way to the condenser.

Cross-int. 347. In giving the height of the still in the early part of your examination as about twelve or fourteen feet, you did not include this pipe, I suppose?

Ans. I did not.

Cross-int. 348. Then, from the bottom of the still to the top of this pipe would be from twenty to twenty-two feet, or thereabouts, would it not?

any one, even myself, tampering with or altering the interior of that still; and I would not permit Mr. Merrill, or any one else, to examine that still, except in the presence of witnesses, and that in the day-time; and although I am willing to accord Mr. Merrill permission to go and see and look at the interior of the still, he must do so in the presence of witnesses whom I will appoint and send with him.

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Cross-int. 348. Then, from the bottom of the still to the top of this pipe would be from twenty to twenty-two feet, or thereabouts, would it not?

Ans. It would be from eighteen to twenty feet. I found yesterday on examining the still that the interior height of the still was a little less than I stated at first.

Cross-int. 349. When this still was in use for distilling, was the pipe A 1 surrounded with any casing of brick or other material?

Ans. I don't think it was.

Cross-int. 350. Did the still stand in the open air?

Ans. It did not. It was in a brick building covered by an iron roof.

Cross-int. 351. Was it so enclosed in 1867?

Ans. It was.

Cross-int. 352. Mr. Merrill judges the distance from the superheaters to this still to be about fifty feet. Will you state whether you think his judgment is correct or not?

Ans. It is not.

Cross-int. 353. Will you state the distance from measurement, if you know it, or give your judgment of it?

Ans. I should say about twenty-five feet. In fact, I don't think it was so much. Formerly, it was about six feet. That was in the early part of 1870.

Cross-int. 354. When did you first put up a superheater, and what was its distance from this still then?

Ans. Early in 1867 I put up a superheater, and its distance from this still was from four to six feet.

Cross-int. 355. Where did you procure this first superheater?

Ans. I made the first one myself, of wrought-iron pipe.

351 Cross-int. 356. When did you first put one up with cast-iron pipe, and where did you procure it?

Ans. I put up one of cast-iron pipe in the fall of 1867 or in the spring of 1868. I procured it early in 1867, from James Marshal and Company, of this city. We had a row about it.

Cross-int. 357. Will you describe the wrought-iron superheater which you made yourself early in 1867?

Ans. I presume it was made of about two-inch pipe, running backward and forward over a furnace. We have been in the habit of altering and changing the size and character of our superheaters so frequently that I forget the size of the pipe.

Cross-int. 358. What were the dimensions of the pump you used in 1867 for pumping off the vapors from the still you then had?

Ans. There were two vacuum-pumps and two steam-cylinders, direct-acting, with fly-wheel, and coupled together. The steam-cylinders, I think, were about twelve inches diamater. The pumps were double-acting, and, I should say, eighteen or twenty inches interior diameter. I think the stroke of the pumps were about fifteen to twenty inches. They could be worked separately or together, at pleasure.

Cross-int. 359. About how many strokes per minute did you commonly run them?

Ans. From fifteen to forty strokes; I should say that was about the maximum rate at which we used them—that is, each pump. We could run them a great deal higher if we wished to. Forty revolutions of the fly-wheel per minute would make eighty strokes of each pump, or one hundred and sixty strokes in all. I call the forward and backward movement of the piston each one stroke, making two strokes for each revolution of the fly-wheel.

Cross-int. 360. Where did you procure this pump?

Ans. From Hugh M. Bole and Company, engine-builders, of this city.

Cross-int. 361. Will you furnish us with samples for examination of

your oils corresponding with Exhibits Nos. 54, 55, and 56; say a quart of each?

Ans. I will.

Direct resumed:

Int. 195. What proportion does Oil Creek oil bear to the whole petroleum stock in this market, as a general thing?

352 Ans. In this market we get very little Oil Creek oil. I think the most of our oil comes from Parker and below Oil City. Probably one-fourth may come from Oil Creek.

Int. 196. You decline to answer the question what kind of oil was the twelve thousand barrels you referred to in answer to the 130th cross-interrogatory. State when that lot of oil was run.

Ans. Since last fall. It was selected from localities and wells which my own experience in the oil business has taught me are the best for the purposes for which I use them.

Int. 197. State as near as you can the quantity of neutral topaz oil, with the paraffine oil in it, which you produced in the summer of 1867, and also the quantity you produced in the summer of 1868, and also state what you did with the oil so produced which was not sold in either of those seasons.

Ans. In the summer of 1867, I should say I produced between one hundred and one hundred and fifty barrels of neutral topaz oil with the paraffine in. I kept almost the whole of this oil until I commenced running in 1868. During 1868, and before I had my presses ready to press, I had, I should say, five hundred barrels frozen, by natural cold, ready for the presses. I presume I also had some in tank. The oil made in 1867 I presume was mixed up with the oil produced in 1868.

Int. 198. In the pamphlet and prospectus put out by you in the summer or fall of 1867, and in the newspaper articles referred to as published in the Pittsburgh Commercial of that year, we find no allusion to your production of neutral topaz oil. Why was this?

Ans. In 1867 there was no large demand in our home market here for petroleum lubricating oils. The market was for illuminating oils, and the attention of our manufacturers here had not been directed to anything else. I had been the builder of almost every large refinery here during 1861 and 1862. I had also been their instructor in the manufacture of illuminating oils. When I built my Eclipse Refinery, at the Sharpsburg bridge, I knew what valuable products in the shape of lubricators could be obtained from petroleum. In the summer of 1867, when I found myself embarrassed for want of capital to carry out my designs, I published the prospectus and pamphlet mentioned. I wanted to keep quiet on the subject of lubricating oils, so as not to direct too much attention to it. I wanted to get a good start ahead of any

353 one else, before I talked too much about the special products, which I designed producing largely, and I deemed this the most prudent course to pursue, until I had acquired the necessary capital to carry out my plans, and for this reason I neither made any mention of neutral topaz oil or of refined paraffine, but I simply contented myself by saying that it was unnecessary in the manufacture to produce such a large amount of tar and coke, amounting about that time to from eight to twelve per cent. of the entire petroleum consumed here, which was about a million barrels annually. This tar and coke are the inevitable products of distillation by fire, or by fire and steam, or superheated steam as auxiliaries. Up to and at this time tar was almost valueless, and the great majority of that produced was thrown into the Allegheny River.

Hundreds of thousands of barrels of tar up to this time, and even after this, had been so wasted and lost, and even to this day it is almost a valueless product, not being worth one-half the price of the crude petroleum. Since I commenced the Eclipse Works, early in 1867, I have never made one single pound of tar or coke, and to this day I am the only manufacturer in the United States who manufactures oils by the use of superheated steam in vacuo, with the exception, I may say, of a very small concern in Rochester, New York, who work in direct violation of my patents; at least I believe so.

Int. 199. In your pamphlet published in August, 1867, you speak not only of the burning oil produced by your new process, but also of the heavy green lubricating oil (twenty to twenty-eight Baumé) produced as a residuum; why did you refer publicly to your production of this heavy green lubricating oil, and not to your neutral topaz oil, at that time?

Ans. I referred to the heavy green oil so as to show that our residuum was a valuable instead of a worthless product like tar or coke. If I had talked about oils and products which people here knew nothing about, and which required market to be made for them, they would have been rather shy of loaning me their capital.

Int. 200. There was, then, a market already for the dark, heavy green lubricating oil?

Ans. There was.

Int. 201. In your answer to the 163d cross-interrogatory you speak of having in the year 1867 expressed the paraffine from a small
354 quantity of neutral topaz oil after freezing it. Please state in what part of the year 1867 that was, about how much neutral topaz oil you so pressed, and how it was frozen and pressed.

Ans. During the summer of 1867 I had taken up to my house about a bucketful of the paraffine oil, distillate, or neutral topaz oil, as I now call it. I froze it in ice and salt. I put it in cloths and expressed the oil in an impromptu lever-press. I took the product into my laboratory, which was in the house, attached to my photograph-room. I made different experiments with it. I sunned some of it by exposure in my photograph-basins on my porch.

Int. 202. What became of this product after the paraffine had been so expressed from it, if you know?

Ans. Some of it I took to the works again; a bottle of it I took with me to New York; the balance was burned when my house was destroyed by fire in the fall of 1867.

Int. 203. You declined to answer the question to whom since 1867 you have sold paraffine oil, with the paraffine not removed, under the name of neutral topaz oil. Since what time have such sales been made?

Ans. The large sales have all been made since I commenced to run my Aladdin Works.

Int. 204. You have said, describing your operations in 1867, that you turned steam on your still from one hundred and thirty to two hundred pounds pressure per square inch; is that the customary pressure in this section of country with the kind of engines you use?

Ans. It is the custom in manufactories here to carry from one hundred to one hundred and fifty pounds pressure upon the steam-boilers. I have carried on boilers and on the pipes in vacuum-stills three hundred to three hundred and fifty pounds pressure per square inch.

Int. 205. As regards the presence of cotton or woolen mills for the purposes of which I understand the neutral topaz oil to be chiefly in request, how does this section of country compare with New York State and the East, and also with the West?

Ans. We have only two or three small cotton mills here; there may be some woolen mills. They must be very small, or I think I should know of them. I know little about the West. The sales of my neutral topaz oil are made to dealers, who compound and sell to the consumer. I do not as a general thing sell to the consuming trade.

355 Int. 206. You have several times in the course of your examination, both direct and cross, spoken of the process of distilling petroleums with the use of vacuum, as broadly distinguishable from the process of distilling them by fire, with or without steam or superheated steam as auxiliaries, but without the use of a vacuum. Will you please explain and illustrate this distinction?

Ans. In distilling petroleum by fire-heat, or by fire-heat with steam or superheated steam as auxiliaries, without a vacuum, the oil in the still is decomposed, more or less. Carbon is liberated, and precipitated as coke and tar—non-condensable gases are formed and pass off into the atmosphere—water is formed and runs over with the distillate, which has a bad odor, and a blue tint. If such distillation is effected by the employment of a vacuum, or, in other words, the removal of atmospheric pressure, no carbon is liberated, because no decomposition takes place, and the distillate has not a bad odor, and the blue and green tints which accompany fire-distillates are absent. The principle of distillation, or I would say of evaporation, of organic bodies in vacuo, prevents decomposition on account of the low boiling-points. In the manufacture of sugar, for instance, it prevents the decomposition of the sugar into caramel and molasses. In the preparation of different medicinal extracts from plants and roots, the use of a vacuum preserves their medicinal properties unimpaired, whilst, if the same extracts were prepared under atmospheric pressure, they would be more or less destroyed. Many organic bodies which would be destroyed in boiling water, for instance, might be boiled indefinitely in a vacuum without change; water boils in a vacuum at between eighty and ninety degrees Fahrenheit.

Int. 207. You are aware, I suppose, that paraffine lubricating oils made by fire-distillation have more or less strongly a certain pungent smell, which is not destroyed by chemical treatment, but is due to the presence in the oil of light or thin oils; how long have you known that such smell could be removed by distilling off such light oils, and how have you had occasion to know it? I do not now speak of your experiment on the Barren County oil.

Ans. From 1861, when I introduced gauges on petroleum-stills, up to 1866, when I left the Standard Works, I was continually engaged practically in distilling petroleum. Towards the latter end of our distilla-

356 tions, we made more or less heavy paraffine oil. These oils were redistilled, and I have no doubt but I knew in 1861 that by distilling the light oils off from the oil in the still the oil remaining in the still was deodorized, or nearly so, for almost every intelligent practical distiller here who uses gauges on his stills knows the fact, by distilling the light oils off from crude petroleum, that the oil in the still becomes less and less odorous, until it is almost neutral, when at this point, by continued application of heat, it commences to decompose, and acquires the empyreumatic odor peculiar to the ordinary petroleum-tar of commerce.

Int. 208. In your answer to the 84th cross-interrogatory, you described how you worked your still when you made illuminating oil and dark-green lubricating oil, of from twenty-four to thirty gravity, and in the course of your answer you speak of products not apparently coming

under those descriptions; will you look at that answer, and state which of the products there mentioned, if any, was the neutral topaz oil, of that summer?

Ans. After the illuminating oils were all distilled over and the distillate commenced to run thirty-eight degrees, the distillate that ran from thirty-eight to twenty-nine Baumé, which I call paraffine oil, was the neutral topaz oil with the paraffine in it.

Int. 209. How soon after the destruction of your works at the Sharpsburg bridge did you take steps to recommence business?

Ans. I think the next day or the day afterwards. My friends, Messrs. Lockhart and Frew, but Mr. Frew more especially, told me to go and make a cash offer for Aladdin Works. We talked the matter over, and thought it would be better not to be in too great a hurry, as, if we seemed too anxious to get it, they might make me pay roundly for it; so I put a large gang of men to work to clear away the wreck of the old works. This I continued for some three weeks, making a big show of an intention to rebuild the works. I had talked several times with the agent of the Aladdin property about their works. I met him one day on the street and closed the matter in a few minutes. The next day I went up and made arrangements to commence work at Aladdin.

Int. 210. What was your financial condition after the destruction of the works at the Sharpsburg bridge?

Ans. I lost nearly two hundred thousand dollars, and my financial condition was very embarrassing. I had not a red cent available at the time, that I know of.

357 Int. 211. I suppose then you built and equipped the works at Aladdin by the use of borrowed money?

Ans. I did not. I had very good credit. I started my works rapidly, made a lot of good purchases in crude oil, and made a good deal of money. I spent a large amount of money on the works, and made enough to do that and a good deal more.

Int. 212. What was the capacity of the refinery at the Sharpsburg bridge just before the fire?

Ans. We could run from two to three hundred barrels of oil per day.

Int. 213. What is the present capacity of your works at Aladdin?

Ans. We can make easily about one hundred and thirty barrels of topaz oil per day; about as much more of other oils; though when we are running on some classes of oils we can and do make five hundred barrels per day.

Int. 214. What sizes of stills have you at Aladdin?

Ans. I have three stills of eighty barrels capacity each; one still of two hundred and fifty barrels capacity; two stills being completed of eighty barrels capacity; one beginning to build of two hundred and fifty barrels capacity. These are all vacuum-stills. I have two stills for distilling off benzole, six hundred barrels capacity each, complete, and two more of the same capacity, ready to put up, and foundations ready.

Int. 215. How many men do you employ at Aladdin?

Ans. I think usually from thirty to forty men, including coal-miners.

Int. 216. Have you any associate in your business?

Ans. I have not. It is conducted and carried on by myself alone.

Int. 217. How was it at the Standard Works from 1866 in that respect?

Ans. At first I built the works with Mr. Hope. In 1863 I owned one-fourth. Subsequently I sold out a portion of my interest, but by repurchase obtained within a fraction of my original interest, namely, one-fourth.

Int. 218. Certain newspaper-notices, Exhibit No. 83, have been shown to you, and you say that you never saw them till you saw them published in the Boston papers; had you given any directions as to notices of that general character, and do you now mean to be understood as disclaiming anything contained in those notices?

358 Ans. I do not disclaim anything contained in those notices, but fully sanction them, and gave instructions, I believe, to Mr. Bartlett, or Mr. Causten Browne, to have them published.

Int. 219. Of what parties did you order your vacuum-apparatus in 1862, as mentioned in your answer to the 56th direct interrogatory?

Ans. I ordered the pump from Mr. Worthington, I think his name is Henry, of New York. I purchased several other pumps from him at the same time. The vacuum-stills I ordered from Carroll and Snyder, of this city, but I had to alter my plans in relation to them, as I stated in my answer to the 56th interrogatory.

Adjourned till 3½ p. m.

Met at 3½ p. m.

Present, as at morning session.

Re-direct examination:

Int. 220. State whether or not the results described in your patent of Feb. 15, 1870, No. 99975, can be produced by following the process described in your patent of December 10, 1867, No. 72126.

Ans. The illuminating oil, the paraffine or neutral topaz oil, and residuum can be produced by following the process described in the patent of December 10, 1867, the same as they can by the patent of February 15, 1870, No. 99975.

Int. 221. State whether or not the results described in your patent of December 10, 1867, No. 72126, can be produced by following the process and using the apparatus described in your re-issued patent, No. 2404, dated November 26, 1866, being a re-issue of the original patent, No. 34324, dated February 4, 1862.

Ans. They can be produced.

Int. 222. In speaking of the operation of distilling petroleum by means of the apparatus used by you at the Sharpsburg bridge, as being continuous, state whether or not you meant to be understood that the crude oil was introduced into the still and distributed over the pipes continuously during the entire operation; I refer to every part of your deposition in which you speak of introducing the crude oil continuously into the still.

Ans. If you mean the first still, I mean by saying that I introduced the crude oil continuously during the operation, this: I introduce

359 crude oil into the still continuously for a considerable period of time, and when the illuminating oils are all distilled off, I shut off the crude-oil supply, and if the residuum has been run into the receiver I immediately open a cock between the bottom of the receiver and the still, so that the heavy oil which has been drawn into the receiver will be drawn back (by lowering the vacuum in it) into the still and redistributed over the pipes. The paraffine oil or neutral topaz oil is then distilled over. It is not absolutely necessary that any lapse of time may occur between shutting off the crude oil entering the still and the heavy oil being drawn from the receiver into the still. The arrangement of cocks to my still permitted the crude oil and the oil from the receiver to be both drawn into the still at the same time or

separately, or one could be shut off while the other was being opened. By the first still I mean the first still I had at Sharpsburg bridge.

Int. 223. You have answered the last question in reference to the first still you had at Sharpsburg bridge. How was it in reference to the continuous introduction of crude oil when you used only one (instead of two or more) of the stills constructed or represented in Exhibit No. 35?

Ans. My whole series of stills were connected with the receiver in the same manner as the still I speak of in the last answer, and could be used singly or simultaneously, in precisely the same manner as I could use the first still I put up, and referred to in my last answer.

Int. 224. State whether or not you did, in fact, occasionally use a single one of the series of stills, shown in Exhibit No. 35, in the manner described in answer to the 222d interrogatory; I mean the answer before the last.

Ans. I have.

Int. 225. State whether or not, when you used the apparatus shown in Exhibit No. 35, using two or more stills as a series, you there introduced crude oil continuously, and into which of the stills of the series?

Ans. It was the usual practice to introduce the crude oil into the top still of the series continuously as long as the operator desired, but the arrangement was such that you could introduce the crude oil into the bottom still of the series first, take the residuum that fell to the bottom of that still and distribute it over the pipes of the still above it, or over those in the still above that again, if the operator so desired.

360 Cross-examination resumed:

Cross-int. 362. In your patent of February 15, 1870, you speak of certain percentages of illuminating oil, neutral topaz, and paraffine which may be obtained. What kind of crude petroleum is it necessary to have to obtain the results there mentioned when carrying on the process as there described?

Ans. I do not know exactly what crude petroleum is specially referred to in this patent, but would say that some of the oils obtained from the wells in the vicinity of Cochran or Foster would produce about the results mentioned.

Cross int. 363. Would the ordinary crude oil of forty-five gravity from Oil Creek or Parker's Landing give those results?

Ans. The ordinary oil from Parker's Landing is about forty-eight degrees, and would not, I think, give such a large yield of paraffine. It is impossible to speak of Oil Creek oils in positive terms, the wells in different localities vary so much; some give very large yields of illuminating oils, small yield of neutral topaz oil, and small yield of paraffine. Some are exactly the reverse—give a small yield of illuminating oil and a large yield of neutral topaz and paraffine. Some yield very little illuminating oil, a large yield of neutral topaz, and no paraffine worth speaking about.

Cross-int. 364. Do you not know that a large portion of the oil from the Oil Creek wells is run into tanks in common, and that as the oils come into market from such tanks they differ very little from each other?

Ans. I know that they differ a very great deal, but since I commenced my works in 1867 I do not remember having received into my works at any one time for purposes of distillation by myself any quantity of oil that came from Oil Creek. I have always purchased my crude oils in other localities.

Adjourned till to-morrow at 9 a. m.

Cross-examination resumed:

Cross-int. 365. Have you ascertained the particulars inquired of in respect to the articles purporting to be copied from the Pittsburg Commercial, to which your attention had been previously directed?

Ans. I have, and find that I was charged in 1867 with several
361 local articles, besides advertisements. I never was aware until this morning that ever I had paid a cent for a local article. I presume the dates on the exhibits are the correct dates of publication.

Redirect examination:

Int. 226. From whom and when did you ascertain that you had paid for locals in the Pittsburg Commercial in the year 1867?

Ans. I learned it this morning from the book-keeper of the concern.

Int. 227. Do you now recollect whether or not, at the time when you had the bill for advertising and locals inserted in the year 1867 in the Pittsburg Commercial, you were aware that you were paying for the locals in question?

Ans. I was not.

Int. 228. Did the book-keeper furnish you this morning with a memorandum of the charges made for the advertising and locals in question?

Ans. He furnished me with a slip containing some dates and amounts for items in 1867 and 1868.

Int. 229. Please state what those items were, giving the dates, particulars, and amounts, during the year 1867, as he gave them to you.

Ans.

Aug. 3, 1867,	local and 50 papers		$36 90
17	"	Prospect Eclipse Co	39 00
"	"	local	17 80
Sep. 10	"	"	10 60
11	"	"	13 60

Int. 230. State whether or not the above statement, as copied on the record as answer to the last question, is an exact copy of the pencil memorandum furnished you by the book-keeper referring to items charged in the year 1867.

Ans. It is.

HERBERT W. C. TWEDDLE.

362 EXHIBIT No. 71.

The Eclipse oil refinery—Dr. Herbert W. C. Tweddle's new process of manufacturing illuminating oils, etc.

Of the many and various sources of wealth in which this country abounds, none is more important than the great oil-fields of Pennsylvania, Ohio, West Virginia, etc. These have added immensely to our prosperity, and afford a profitable means of investment for capital and an extensive field for labor. The danger from fire, the laborious detail and general inconvenience arising from the manufacture of petroleum oils, has been a constant source of loss and vexation to all who are engaged in the refining business. For a considerable time the problem has occupied some of the most scientific minds in the country, of overcoming these objections and at the same time of reducing the cost incidental to the manufacturing of the oil. It has remained for our well-known fellow-citizen, Dr. Herbert W. C. Tweddle, a gentleman learned in the sciences, and who has erected a number of the largest and most successful oil-refineries in operation, to develop a system which pre-

sents numerous advantages over the present method of making illuminating oils, and which, we are convinced, will effect a total and radical change in this branch of industry, superseding all other processes.

Dr. Tweddle has lately constructed a new refinery—the Eclipse—on the east bank of the Allegheny River, adjoining the Sharpsburg bridge, four miles from this city, at the terminus of the Citizens' Passenger Railway. These works we visited a few days ago for the purpose of investigating Dr. Tweddle's new process, which consists of several patents granted to him by which all the hazard and risks attendant on the use of fire in distilling the crude oil, and the expense and nuisance of subsequent purification by acids and alkalies, are entirely avoided.

The process is carried on wholly by steam, no fire or chemicals being used, and we found that the oil produced is superior in every respect to that made in the ordinary way. The motive-power used is a compound engine, with two large pumps, twenty inches in diameter, which moves with noiseless but powerful force. Adjoining the engine-building is a spacious room containing a section of the apparatus. Here the operator merely turns a valve, when the crude petroleum instantly comes from the store-tank, a huge vat of twenty thousand barrels' capacity,
363 and one hundred and fifty feet distant. The oil indicates its presence by rapidly ascending a glass tube to a designated height. The valve is then shut and another is opened, when the oil passes directly into the apparatus; at the same time the oil in the glass tube is gradually descending. At the trial we witnessed of Dr. Tweddle's new scientific process, it required only from six to eight minutes from the time the crude oil left its store-tank to convert it into pure, refined petroleum, flowing into the refined-oil store-tank almost odorless, non-explosive illuminating oil, at the rate of from fifteen to twenty barrels per hour. The perfect ease, simplicity, and celerity of the operation was surprising, almost magical. There was no odor, no danger, no labor, no noise. Everything was done in quietness, in a cleanly manner, and with remarkable dispatch and to the perfect satisfaction of every beholder, thus rendering a process that has hitherto been as destructive and dangerous as the manufacture of gunpowder perfectly harmless.

Dr. Tweddle proposes to organize a company under the title of the Eclipse Petroleum Refining Company, with a capital of half a million of dollars, five thousand shares at one hundred dollars each.

This company will manufacture illuminating oils, &c., under the patents granted to him, and to grant to refiners and others "rights of use" for a specific bonus or royalty, as the company may in future determine. Some of our best-known and heaviest refiners have already made application to have their apparatus modified or reconstructed upon Doctor Tweddle's new principle. The property upon which the Eclipse Works are erected is most admirably located for making shipments East or West by rail, the Allegheny Valley Railway having consented to construct a telegraph to this city, which will much facilitate all business relative to transportation, and the water-frontage is between five hundred and six hundred feet, and the water is from five to six feet deep at the lowest stage of the river.

There is a large, well-finished double two-story dwelling on the property, besides the warehouse, one hundred feet square, tanks, engines, pumps, pipes, machine-shop, offices, and general equipments. Upwards of ninety thousand dollars have been expended on the real estate and the works, and from twenty to thirty thousand dollars more will be required to complete the apparatus.

364 Some of the more important of the advantages attending the use of Dr. Tweddle's process of manufacturing petroleum may be briefly stated as follows:

First. The use of fire is entirely dispensed with, except under the steam-boilers, which are situated some distance from the apparatus.

Second. Danger from fire is entirely avoided, steam being the only agent used, and it is utterly impossible to ignite oils during the operation; consequently insurance will be reduced to a minimum, and, except for warehouse and stock, is unnecessary.

Third. The use of acids or chemicals to purify the oil is dispensed with, as it can be made better, purer, and superior in every respect without them, whilst the percentage is increased. The fire-test of the oil can be made always from 125 deg. to 130 deg. Fahr., making it a perfectly safe illuminator.

Fourth. Refined oil can be produced at one dollar per barrel less than by the present process in use.

Fifth. In the present section of apparatus a period of from six to eight minutes elapses from the time the crude petroleum leaves the store-tank until it is returned to the refined-oil tank finished oil.

Sixth. The whole apparatus is under the control of one operator; there are no laborious details to attend to, the opening and closing of a few valves constituting his entire work. There is no charging of stills, putting on or taking off man-heads; no cleaning out of tar or coke; no bad odors or dirt or destruction of apparatus. It works almost automatically and transforms a disagreeable occupation into a pleasant one.

Seventh. The apparatus can be put in operation in a few minutes and can be run continuously. It can be stopped instantly, so that it involves no necessity to work on the Sabbath.

The great and long-recognized desiderata secured by the introduction of this process can at once be appreciated by the public, especially by Pittsburghers, who are familiar with the numerous conflagrations in refineries during the past six years. So disastrous have they been that many insurance-companies refuse to take risks, and the few that do so obtain their own terms and the highest premium.

The Eclipse is the fourteenth refinery constructed by Dr. Tweddle in this vicinity. They number amongst them the largest and
365 most successful, viz, the Patrona, Excelsior, Brilliant, Eagle, Standard, etc. Dr. Tweddle deems the Eclipse worthy of the name it bears, and will bring the best efforts of his experience to make it complete and satisfactory to the stockholders.

EXHIBIT No. 72.

Dr. Herbert W. C. Tweddle's new process for manufacturing illuminating oil.

We direct the attention of our citizens generally, and capitalists and those interested in petroleum oil particularly, to the prospectus of the Eclipse Petroleum Refining Company, which will be found in another column. This company will be organized to manufacture petroleum oil under patents granted to our distinguished fellow-citizen, Dr. Herbert W. C. Tweddle, whose skilled scientific experience in the refining of petroleum oil is familiar to almost every one in this region of the country. Dr. Tweddle has given more patient study and diligent investigation into this important branch of business than perhaps any other gen-

tleman connected with it, and the result is not only seen in the creation of a trade which owes its wide diffusion largely to the improvements he has introduced from time to time, not merely in the erection of those immense refineries which he has planned and constructed, but also in the discovery of a new process of manufacturing illuminating oils, which we do not hazard in saying will completely revolutionize the petroleum-oil-refining business, for the reason that it possesses so many advantages over every other known process that the natural result of its introduction and practical demonstration and successful operation must make it at once the most desirable, both for the manufacturer and consumer. We have lately published an account of this new and valuable process which was extensively read with deep interest, but we cannot forego the present opportunity afforded us for saying a word in relation to one or two things that appear to us to be highly important. We think the time has come when the destruction of life and property by petroleum should be ended. Scarcely a day passes that does not bring to
366 us accounts of the most deplorable devastations of life and property occasioned by the oil taking fire in the refineries. So far as the danger arises from the process of its manufacture, we say deliberately that Dr. Tweddle has furnished us with the true theory—now so happily and successfully proved—of averting entirely this danger. We have always believed that disasters by fire were preventable in refining, and we cannot think that any reasonable and legitimate commercial interest is promoted by adhering to a method which is so pregnant with danger as the present general system of manufacturing petroleum illuminating oil. Dr. Tweddle's invention is a simple and practical prevention, which we hope to see universally adopted.

The other important thought in our mind is the pollution of the Allegheny River, from which our city is supplied with water. The establishment of numerous petroleum-refineries along its banks has made it a cess-pool of filth and corruption, alike destructive to its once crowded finny inhabitants and to the health of all who are compelled to drink its waters. Skillful analysis has shown this to be the fact, and no filtration can purify water polluted by a poison so subtle and powerful as the refuse of these refineries. By Dr. Tweddle's process there is none of this disgusting substance created, and therefore none is cast into the river. There is a sanitary importance attached to this invention which must not be overlooked, and we trust the enterprise in which Dr. Tweddle is engaged will meet with a prompt, liberal, and hearty support. We regard him as a benefactor ever to be cherished and honored, who can thus deliver us even in part from the dangers arising from the polluted condition of the Allegheny River.

We hope that the board of health will take the pains to examine Dr. Tweddle's process, and give the people their opinion of its merits as a means of saving human life and improving our sanitary condition.

367 EXHIBIT No. 73.

Prospectus of the Eclipse Petroleum-Refining Co. of Pittsburgh, Pa. Capital, $500,000, 5,000 shares, $100 each.

This company is to be organized to manufacture petroleum illuminating oil, under patents granted to Dr. Herbert W. C. Tweddle.

The patents, works, grounds, &c., become the exclusive property of the company.

The property on which the Eclipse Oil-Refining Works are constructed

adjoins the Sharpsburg bridge and consists of five or six acres. It presents a frontage on the Allegheny River of about five hundred feet.

There is always deep water at this point, even at the lowest stage of the river, and there is a safe harbor from ice during the winter. The Allegheny Valley Railway passes directly in front of the works on the bank of the river. The Citizens' Passenger Railway has its terminus at the works. The Sharpsburg bridge crosses the Allegheny River opposite the works. At Sharpsburg the Western Pennsylvania Railway Company has erected a station, spacious freight-houses, &c.

The works, when completed, are designed to refine one thousand barrels of oil per diem.

The following are a few of the advantages resulting from Dr. Tweddle's new process:

The business is entirely divested of all its present dangerous and hazardous character. No fire is used, save beneath the boilers, steam being the only agent employed.

The use of acids and alkalies are entirely dispensed with, and the oil produced is made better and purer without them.

Besides, the fire-test is made higher by this process, and the oil a safer illuminator and almost odorless.

The whole apparatus is under the control of one operator whether one hundred or one thousand barrels of oil per day are manufactured. The duty of this operator consists in the opening and closing of a few valves.

There is no tar or coke to be cleaned out, and the apparatus can be started and stopped in a few seconds, thereby entirely doing away with the necessity of working on the Sabbath day.

There is no bad odor generated in the manufacture of oil by
368 this process, and no destruction to the apparatus. The waste gases are utilized as fuel and the residuum converted into lubricating oil equal in all respects to that from West Virginia and Ohio.

By this process oil can be produced at a cost of one dollar per barrel less than by any other in use, and at the same time a greater percentage is obtained. Less amount of capital is required to carry on the business for the reason that the crude material is so rapidly and entirely transformed into the marketable product. There are many and various facts which the operation of manufacturing oil by this process will demonstrate to the observer, and which are not enumerated here.

The Eclipse is the thirteenth refinery constructed by Dr. Tweddle in this vicinity.

They number amongst them our largest and most successful: the Petrona, Excelsior, Brilliant, Eagle, Standard, &c. He deems this one worthy of the name it bears, and will bring the best efforts of his experience to make it complete and satisfactory to the stockholders.

Only one hundred and fifty thousand dollars' worth of the capital stock of the Eclipse Petroleum Refining Co. will be disposed of.

The books are now open at the office of S. M. Kier & Co., No. 359 Liberty street, near the Union Railway depot.

Specimens of the products can be examined and compared with those by the old process at S. M. Kier & Co.'s office.

Cards of admission to the works can be obtained from Dr. Tweddle, when subscribers can have the rationale of the process explained.

EXHIBIT No. 74.

Highly successful test of Dr. H. W. C. Tweddle's new process of manufacturing illuminating oil.

Dr. Herbert W. C. Tweddle's new process of manufacturing illuminating oils from petroleum, without the use of chemicals or alkalies, and solely by the adaptation of steam, was thoroughly tested yesterday afternoon at Dr. Tweddle's new Eclipse Oil-Works, at Sharpsburg bridge, and in the presence of a number of gentlemen who are
369 engaged in the business of refining oil. The section of the apparatus now completed was put into operation at two o'clock, when the crude oil from the store-tank was turned on, and in precisely four minutes it began running into the receiving-tank pure, refined, white, non-explosive illuminating oil, and at the expiration of just seven minutes the refined oil flowed copiously into the tank.

The crude oil used was gauged, previous to being refined, in the presence of the gentlemen who were on the ground, and at six o'clock, p. m., the oil had all been refined, and the test was found to be a fraction over seventy per cent. The process of refining was closely watched by the gentlemen present, and it was found that there was no variation whatever in the average product per hour.

Every one present expressed himself entirely convinced of the superiority of Dr. Tweddle's process over that now in use, and the latter is exceedingly dangerous as well as very expensive and irksome. The spectators availed themselves of the opportunity to make this test complete in every detail, and the result was entirely satisfactory to them, and fully demonstrated all that Dr. Tweddle has claimed. Had the whole apparatus been in operation the test would have been far greater We are not able to lay before our readers the certificate that the test was all we have stated, because we were not able to obtain it up to the hour when we returned to the city, but we shall give it a place in these columns to-morrow morning. Dr. Tweddle's process is now demonstrated by practical tests, concerning every detail in the manufacture of illuminating oils, to be the safest, cheapest, cleanest, and most profitable, and we confidently predict that its general adoption by oil-refiners will not be delayed a great deal longer.

EXHIBIT No. 75.

Report of the committee appointed to examine Dr. H. W. C. Tweddle's process of manufacturing petroleum oil.

We, the undersigned, a committee organized to report on the efficacy and practicability of Dr. H. W. C. Tweddle's process of refining petroleum, assembled at the Eclipse Refinery, Monday afternoon, Sep-
370 tember 9th, thoroughly tested the apparatus and examined the oils produced by it.

At 2.05 p. m., crude oil, 43 deg. gravity, was introduced into the apparatus and steam turned on. In four minutes the refined oil made its appearance and in seven minutes was running a copious stream.

About fifty barrels was introduced by 3.30 o'clock, and at 7 o'clock p. m., or five hours' time, 74 deg. of refined oil was produced, and 22 deg. of lubricating oil.

The simplicity of the apparatus, and the thorough manner in which the work is performed, is remarkable. Danger from fire or explosion is

impossible. No unpleasant odor or dirt is apparent, and the oils produced are superior in every respect to any that have hitherto come under our observation. We examined several hundred barrels which had passed inspection "prime white" which had a fire-test of 130 deg. to 170 deg. Fahrenheit.

The apparatus and process is in every respect superior to that in ordinary use, and it is everything that Dr. Tweddle claims for it, and we have no doubt but that when the whole apparatus is completed the results will far exceed those already attained.

The lubricating oil produced is a superior article, having been subjected to long and severe test, and its value will fully cover all costs of producing the refined oil.

As no acids, alkalis, or chemicals are used in this process, the wear and destruction of apparatus is reduced to a minimum.

Archibald Kelly, of Anchor Petroleum Refinery; Reuben Miller, late of Petrona Refinery; Robert Dickson, president National Trust Company; Davis & Phillips, W. H. Cluley, Thomas Marshall, Thomas T. Everett.

United States inspector's certificate.

Product of 1,922 gallons of crude petroleum distilled by Dr. H. W. C. Tweddle's process:

Refined oil, 1,416 gallons; 74 per cent.

Lubricating oil, 430 gallons; 22 per cent.

JOHNSON LITTELL, *U. S. Inspector.*

Twenty-second district, Pa., September 9, 1867.

371 As we stated yesterday that we would to-day give our readers the assurance that what has been claimed for Dr. Tweddle's process has been fully demonstrated, we therefore present the foregoing certificate, including one from United States Inspector Littell, of this district, giving facts in regard to the test made on Monday last. We think that this last proof of the superiority Dr. of Tweddle's process over all others ought to satisfy the most prejudiced individual of its importance and great value. The process can be seen at any time, at the Eclipse Oil Refinery, Sharpsburg bridge.

EXHIBIT No. 76.

Report of the committee appointed to examine Dr. H. W. C. Tweddle's process of manufacturing petroleum oil.

In our notice yesterday morning of the report of the committee appointed to examine Dr. H. W. C. Tweddle's process of manufacturing petroleum oil, there was a typographical error, (which we hasten to correct,) in the third paragraph of the report. To read correctly it should have read as follows:

"About fifty barrels was introduced by 3.30 o'clock, and at seven o'clock p. m., or five hours' time, 74 per cent. of refined oil was produced, and 22 per cent. of lubricating oil."

We repeat that we think this last proof of the superiority of Dr. Tweddle's process over all others ought to satisfy the most prejudiced individual of its importance and great value. The process can be seen any time at the Eclipse Oil Refinery, Sharpsburgh bridge.

EXHIBIT No. 77.

Eclipse Petroleum Refining Company; capital $500,000; *5,000 shares,* $100 *each.*

Dr. Herbert W. C. Tweddle proposes to organize a company with the above title and capital, to manufacture illuminating oils, &c., under the patents granted to him for improvements in manufacturing
372 petroleum oils, and to grant to refiners and others "rights of use" for a specific bonus or royalty, as the company may in future determine.

The property on which the Eclipse Works are constructed adjoins the Sharpsburg bridge, about four miles from Pittsburgh. It comprises between five and six acres, and has a frontage on the Allegheny River of between five and six hundred feet, and the water is from four to six feet deep along the entire front at the lowest stages of the river.

The Allegheny Valley Railway intersects the property, and has two long switches for use of the works. Shipments can be made to any point east or west without change of cars. The station will be located on the property, and as soon as desirable the railway company will construct a telegraph to the city, which will much facilitate all business relative to transportation. The terminus of the Citizens' Passenger Railway is at our door, and the Western Pennsylvania Railway station is at the opposite end of the bridge, so that the works are easily accessible at all times. A fine, large, well-finished, double two-story dwelling-house is on the property.

The works are designed to refine one thousand barrels of oil daily—the warehouse, tanks, engines, pumps, pipes, machine-shop, offices, and equipment having been constructed with that object in view. On the real estate and works ninety thousand dollars have been expended, and from thirty to forty thousand dollars will be required to complete the apparatus, one section of which, with the engine for the full set, is now in operation.

Some of the more important of the advantages attending the use of Dr. Tweddle's process of manufacturing petroleum may be briefly alluded to.

1st. The use of fire is entirely dispensed with except under the steam boilers, which are situated some distance from the apparatus.

2d. Danger from fire is entirely avoided, steam being the only agent used; and it is entirely impossible to ignite the oils during the operation, consequently insurance will be reduced to a minimum, and except on warehouse and stock, unnecessary.

3d. The use of acid or chemicals to purify the oil is dispensed with, as it can be made better, purer, and superior in every respect without them, whilst the percentage is increased. The fire-test of the oil
373 can be made always from 125° to 130° Fahrenheit, making it a perfectly safe illuminator.

4th. Refined oil can be produced at one dollar per barrel less than by present process in use.

5th. In the present section of apparatus, a period of from seven to ten minutes elapses from the time the crude petroleum leaves the store-tank until it is returned to the refined-oil tank finished oil.

6th. The whole apparatus is under the control of one operator; there are no laborious details to attend to, the opening and closing of a few valves constituting his entire work. There is no charging of stills, putting on or taking off man-heads, no cleaning out of tar or coke, no bad

odor, or dirt, or destruction of apparatus. It works almost automatically, and transforms a disagreeable occupation into a pleasant one.

7th. There are no waste products. The non-condensible gases are conducted under the steam-boilers and utilized as fuel. (Patent No. , granted to Dr. Tweddle, .) The residuum, after the illuminating oils are obtained, is a heavy green lubricating oil from 20° to 28° Baumé. It is almost odorless, and so similar in appearance to the natural lubricating petroleums from the Ohio and Virginia wells, as to deceive the best judges. It is superior to them, or the best lard oil, for cutting screws or pipes, bolt-cutting, drilling wrought iron, and general use of lubricating oils. It will never gum.

8th. The apparatus can be put in operation in a few minutes, and can be run continuously. It can be stopped instantly, so that it involves no necessity to work on the Sabbath.

The great and long-recognized desiderata secured by the introduction of this process can at once be appreciated by the public, especially by Pittsburghers who are familiar with the numerous conflagrations in refineries during the past six years. So disastrous have they been, that many insurance companies refuse to take risks, and the few that do so obtain their own terms and high premiums.

To give a more definite idea of the saving effected by this process, a few figures will render its pecuniary advantages more apparent. Last year Dr. Tweddle manufactured from about 90,000 barrels of crude petroleum 66,000 barrels of refined oil, or 74 per cent.; to obtain this percentage he redistilled the tar down to coke.

374 It required to refine it—

594,000 lbs. sulphuric acid, costing	$23,760 00
13,000 " soda	1,200 00
	$24,960 00
This is entirely saved, as well as 20 cents. extra labor per barrel	13,200 00
6,000 bbls. more illuminating oil would have been obtained, worth, say, $8 per bbl	48,000 00
8,000 bbls. of lubricating oil, say, $5 per bbl	40,000 00
Or there would have been made an extra profit of	$126,160 00

Pittsburgh refiners estimate the cost of manufacturing refined oil at from $1.30 to $1.70 per barrel. The following is the absolute cost of manufacturing 30,000 barrels of refined oil during six months last year:

Labor:	
Distilling and refining	$3,462 70
Laborers around works	4,137 93
Cooperage, cementing, painting	6,649 79
Blacksmith, boiler-makers	1,376 00
Machine-shop	900 00
Brick-layers, carpenters	$1,500 00
	$18,026 42
270,353 lbs. sulphuric acid	10,610 96
55,000 bush. coal	5,259 15
6,225 lbs. soda	935 00

13,233 " glue	1,942 83
25,000 " paint	2,425 00
240 gallons boiled oil	431 25
60,000 bungs	300 00
Paint-brushes	107 00
7,701 lbs. hoop-iron	677 57
1,000 " hoop-rivets	203 00
Horse-feed, hay, harness	624 63
	$41,242 81

Or $1.37½ cents per barrel.

375 By Dr. Tweddle's process the cost of manufacture is about 50 cents per barrel.

By the ordinary process in use, very high temperature (at the latter stages of the process exceeding 600° Fahrenheit) is used in distilling, and from ten to twelve per cent. of the oil is decomposed or carbonized; usually four or five per cent. of tar is run from the stills into the river, and from one to three per cent. is carbonized by the sulphuric acid, or is lost in subsequently washing in the agitators. The following is about a manufacturer's analysis of 100,000 barrels of crude petroleum:

		Dr. Tweddle's process.	
Water	3,000		3,000
Benzole	8,000		8,000
Illuminating oil	75,000		80,000
Tar, coke, noncondensible gases, and loss in refining	12,000	Lubricating oil,	8,000
Loss in leakage, handling, and evaporation	2,000		1,000
	100,000		100,000

By Dr. Tweddle's process the oil during the operation is in a vacuum, and the temperatures are very low, seldom exceeding 350° Fahrenheit, which heat is obtained by steam, so that none of the oil is burned or wasted by decomposition.

The Eclipse is the thirteenth refinery constructed by Dr. Tweddle in this vicinity. They number amongst them our largest and most successful: the Petrona, Excelsior, Brilliant, Eagle, Standard, etc. He deems this one worthy of the name it bears, and will bring the best efforts of his experience to make it complete and satisfactory to the stockholders.

Specimens of the products can be examined and compared with those by the old process, at the office of S. M. Kier, Liberty street.

Cards of admission to the works can be obtained from Dr. Tweddle, when subscribers can have the rationale of the process explained.

376 EXHIBIT No. 78.

Eclipse Petroleum Refinery, Pittsburgh, Pa. Herbert W. C. Tweddle, sole manufacturer of Lightfoot's currying and harness oils, under patents owned by the Lightfoot's Currying Oil Co. and himself.

Directions for using my patent curriers' oil on leather.

Vacuum oil, for stuffing. Use this oil warm. Use two gallons of this with one of fish oil; have your tallow a little more than milk-warm, but

never hot; pour the mixed oil with the tallow in sufficient quantity to make your stuffing of the consistency you wish. If you want the stuffing still softer, after it is well set, add the mixed oil, viz, two gallons vacuum oil with one of fish oil, in sufficient quantity to suit.

My oil will effectually prevent any gum or frying, and keep the leather in good condition.

Vacuum oil is a heavy black oil, an excellent article for stuffing.

A A X oil, for finishing. Use two gallons of this with one of fish oil. Let it always be milk-warm, or warmer if desired. The A. A. X. oil is very sweet, and a superior article for finishing, leaving the leather very soft and pliable, and keeping it in perfect order.

A X oil, for oiling off. Use two gallons of this with one of fish oil.

HERBERT W. C. TWEDDLE.

Prices this day.—Vacum oil, for stuffing. A A X A X.

N. B.—Curriers will understand that the leather should always be wet in applying oils.

377 EXHIBIT No. 79.

ECLIPSE PETROLEUM REFINERY,
Pittsburgh, Pa., Sept., 1868.

A complete success! More than seven hundred tanners, curriers, harness-makers, and morocco-dressers are using the Lightfoot's stuffing, finishing, & harness oils. Their emphatic testimony is that it is a perfect substitute for straits and other oils heretofore used in the stuffing and finishing of all kinds of leather.

Lightfoot's patent currying oil for leather. Patented Nov. 16, 1863, *Dec.* 22, 1863, *June* 14, 1864.

It has no equal. For softening, coloring, and finishing; for stuffing, combined with tallow; for hard-tanned and dry-hide leather; for elasticity and giving permanent weight; for oiling sole-leather; for mixing with lamp-black coloring; for preventing gum, fry, mould, or decay; for treeing boots. It remains in the leather through all change and exposure. It does not evaporate and is not corrosive. It is more impervious to water than any oil in use. It is a heavy oil of an even grade; it readily penetrates the leather. It is thoroughly deodorized. It is free from any chemicals to impair the quality or strength of the leather. It is good for harness, carriage-tops, &c. It is water-proof, and good for boots and shoes, which will polish well immediately after being used, and never will crack. All belting and hose ought to be greased with this oil.

The Lightfoot's Currying-Oil Company have been at a great expense in perfecting these oils so as to be useful to curriers, and the introduction of petroleum to the trade is due to their efforts.

Some of the advantages of using our oil are, 1st. It is the best in the market. 2d. It is of reliable uniform quality. 3d. Purchasers of the company's agent are protected by the Lightfoot's patents and escape the liability of suits for infringement to which they are exposed in purchasing of others.

I wish it to be distinctly understood that these patents cover the use of petroleum in every form for currying, (stuffing, oiling off, finishing, and coloring leather,) and every currier who purchases of other parties

and uses petroleum or any product or combination of petroleum under the name of vacuum oil or any other name is liable to the Lightfoot Company for infringement of their patents, and will be prosecuted according to law.

378 I am ready to furnish oil prepared for use under the Lightfoot patents of all the varieties required by curriers in any quantity and at reasonable prices, which I warrant equal to any oils in the market.

Especial attention is invited to my stuffing oil, which is confidently recommended as the best and cheapest article for the purpose in the market. It gives more weight than the best neat's-foot oil.

I have expended upwards of $100,000 in apparatus, and have exclusive right of manufacturing these oils under my patents, the only one under which these oils can he manufactured. The Lightfoot Company have granted me the exclusive right of selling in Pennsylvania and other territories under their patents.

HERBERT W. C. TWEDDLE.

ECLIPSE PETROLEUM REFINERY,
Pittsburgh, Pa., Sept., 1868.

Caution against purchasing petroleum in any of its forms for currying purposes except from the undersigned.

U. S. circuit court, February 12, 1868. Before Judge Lowell.

THE LIGHTFOOT'S CURRYING-OIL COMPANY
vs.
JOS. A. DALTON.

Hearing upon a bill in equity praying an injunction to restrain the defendant from infringing upon three patents granted B. H. Lightfoot, viz: For a new and useful improvement in treating tanned leather, dated Nov. 17, 1863, and also the same dated June 14, 1864; and for a new and useful improvement in coloring tanned leather, dated Dec. 22, 1863, all now owned by the complainants for the use of petroleum and other hydrocarbons in corrying.

The court decided that these were good and valid patents, and the infringement consisted in using oil purchased of other parties than the Lightfoot Company or its agents in the business of said Dalton as a currier, and ordered, after hearing, a decree of perpetual injunction to restrain the infringement.

B. R. Curtis and D. A. Gleason for complainants.

In conformity with the above, the company will institute legal proceedings against all parties who use petroleum oil in any form for currying purposes not purchased of the Lightfoot Oil Company or its authorized agent.

HERBERT W. C. TWEDDLE.

379 REFERENCES.

Tanners.

Jacob Putnam & Co.,	Salem.	Thomas Graham,	Boston.
James C. Stimpson,	"	Daniel Johnson & Co.,	"
Winn, Eaton & Co.,	Boston.	James G. Safford & Co.,	"

William Tidd & Co.,	"	John Winslow,	Mechanics Falls, Me.
John B. Alley & Co.,	"	George Reynolds,	Bangor, "
Chester Guild & Co.,	"	H. C. Trowan,	Woburn, "
E. R. Swasey & Co.,	"	John Ingram,	Lowell, Mass.
J. C. Batchelder,	"	P. P. Clough,	Danbury, Vt.

Morocco Dressers.

Jabob S. Wentworth,	P. Peaver & Co.,
Augustus B. Martin,	Ashbel Waitt,
P. P. Tapley,	P. Lennox.

I am prepared to supply my superior and improved paraffine oils for currying leather, &c., manufactured in vacuo by steam, under patents granted to myself. They are inodorous, leave no smell on the leather, and effectually prevent any gum or frying.

A C, vacuum oil for stuffing. A A A, for finishing. A B, for oiling off.

HERBERT W. C. TWEDDLE,
Eclipse Petroleum Refinery, Pittsburgh, Pa.

EXHIBIT No. 80.

ECLIPSE PETROLEUM REFINING WORKS,
Pittsburgh, Pa., Aug. 21, 1868.

C. TOPPAN, ESQR.:

DEAR SIR: I am in receipt of your valued favor of the 7th inst. and note contents. Within a few days I will forward to Mr. Bartlett some light-colored oil, which I think will be admirably adapted to the purposes of the Lightfoot Co. He will submit it to your inspection, and if it suits I will manufacture it in any quantity that you desire. I have been so busy on large contracts for refined oil that I have not had time to make the dark-colored oil, but will commence on Monday to do so, & will forward some of it. I have not yet received the document
380 which you mention, authorizing me to sell in the Eastman territory. I will be happy to be present at the meeting of your Lightfoot Co. in Sept.

Yours very truly,

HERBERT W. C. TWEDDLE.

I have sent some samples of tanners' oil to Jno. R. Bartlett, Boston, which he will submit to your inspection. One bottle is heavy and much thicker than samples you left, to show you that we can make it thick; the other sample is a very little thicker than sample you left, and fulfils, I think, all the requirements that you desired me to do.

Eclipse Petroleum Refining Works—non-explosive illuminating oil, signal-light oil, for railroads and steamers.

These oils are offered to the public as the safest, best petroleum oils made, photometrical tests proving them superior to any oils hitherto manufactured. They will not smoke the chimney, grease the outside of lamps, or create a disgreeable odor in a room, as all oils which are refined by the use of acids and chemicals do—and will burn the deepest lamps dry without crusting the wick. No one need hesitate about

burning these oils, as they are all submitted to the severest tests before leaving the works.

Benzole, gasoline, rhigolene, manufactured by steam in vacuo, under patents granted to Dr. H. W. C. Tweddle, producer of the celebrated Eclipse Lubricating Oil; in use on all the railroads, iron mills, machine-shops, saw-mills, etc., in the vicinity of Pittsburgh, and proved to be superior and more econominal than any lubricator in use—absolutely free from water, grit, gum, or other impurity—will stand the greatest heat without change.

Read the following certificates:

PITTSBURGH, PA., *March* 9, 1868.

DR. HERBERT W. C. TWEDDLE:

DEAR SIR: We have used your Eclipse lubricating oil in our rolling-mills and both our gas-pipe mills since last fall, and are satisfied that it has more "body" and lubricating qualities than any of the petroleum lubricators, either natural or manufactured, we have hitherto used.

Yours, respectfully,

SPANG, CHALFANT & CO.

PITTSBURGH, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: For the past six months we have used your Eclipse lubricating oil in our planing and saw mills, and find it superior in every respect to any oil we have hitherto used, which has been principally No. 1 lard oil.

Our planing-machines run from 3,200 to 4,000 revolutions per minute, and the journals are kept perfectly cool by oiling them twice daily, and are so clean and free from gum, that in future we shall use your oil exclusively.

Respectfully, yours,

ROBERT HILL.

PITTSBURGH, PA., *March* 9, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: You ask us to give our written opinion of your Eclipse lubricating oil for railroad use, which we do with pleasure.

After thoroughly testing it, we are perfectly satisfied that it is the most economical lubricator in use, and entirely free from all impurities.

We have lately examined a number of our car boxes, and never had them in as good a condition before. After having used West Virginia, and all other kinds of oil, we find yours ahead, and equal to the far-famed Mecca oil, and in future shall use no other kind.

Respectfully, yours,

ARMSTRONG, DICKSON & CO.

PITTSBURGH, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: We have been using your Eclipse lubricating oil since last summer in our different coal works, and are satisfied that it is a very superior lubricating oil, being entirely free from grit, water, or other impurity; its quality and cheapness ought at once to render it a favorite with railroads.

We have 130 cars on the Pennsylvania Railroad and Pittsburgh & Connellsville Railroad, 85 on the Allegheny Valley Railroad, and about 200 pit cars, and a recent examination of the car boxes has proved them to be in the very best condition.

Yours, respectfully,

CHAS H. ARMSTRONG.

PITTSBURGH, *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: During the past half year we have used about forty barrels of your Eclipse lubricating oil at our coal works and on our coal cars, and we never had any oil to equal it as a lubricator, while its cheapness and purity commend it very favorably to our notice.

Respectfully, yours,

DICKSON, STEWART & CO.

PITTSBURGH, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: Since last fall we have been using your Eclipse lubricating oil, and after subjecting it to the severest test, we are as well satisfied with it as that of the best lard oil.

382 The machinery of our planing and saw mills is all rapid running, our circular saws make nearly 4,000 revolutions per minute, and yet the journals are kept cool and free from gumming.

Yours, respectfully,

M'KEE & DOUGLAS.

HERBERT W. C. TWEDDLE,
Pittsburgh, Pa.

Works at Sharpsburg bridge, office No. 349 Liberty street.

EXHIBIT No. 81.

PITTSBURGH, PA., *Sept.* 29, '68.

Messrs. SECOMB, KEHEW AND THAYER:

DEAR SIRS: Your favor of 26 inst. is at hand and contents noted. Enclosed please find circulars which I have had struck off. I have already addressed them to some 2,000 curriers and tanners. I only regret that I have not got some certificates such as the Rochester Co. attached to their circulars. Would you be kind enough to see Mr. Toppan and arrange with him for me to sell in the Eastman territory. When may I expect the leather samples? I have made a considerable improvement within the past few days in making the tanners' oil. Would it not sell well as a lubricator for r'l'y use, and for heavy machinery?

I make an oil very similar to the A X oil you speak of. With next shipment will send you a sample-barrel. With highest regards,

I remain, yours, very truly,

HERBERT W. C. TWEDDLE.

Tell Mr. Cobb I will supply the co. at the lowest figures at which I can get a very moderate profit, and if I can possibly put the next lot at a lower figure will do so. Oils are firmer here to-day.

EXHIBIT No. 82.

ECLIPSE PETROLEUM REFINING WORKS,
Pittsburgh, Pa., Oct. 6.

Messrs. SECOMB, KEHEW & THAYER:

DEAR SIRS: I am in receipt of your favor of 3rd inst. and note contents. I will forward you this afternoon or to-morrow two hundred barrels more tanners' oil, as approaching the 10 or 12th it is
383 almost impossible to get cars, (our delivery days in Philadelphia being the 15th and last day of each month, there is always a rush of oil at that time.)

I have this day drawn on you at three dys. after sight, in favor of Mess. Spang, Chalfant & Co., for $544, (five hundred and forty-four dollars.) The balance of acct. I may draw for during the week if I require it. I am holding a large stock of crude and refined A. We are certain of better prices or I would not draw so soon.

I am very glad that the oil is so satisfactory, and if you think it best I will just make the oil as it has been hitherto, but I believe it can be improved. Tanners' oil has advanced here twenty cents with' the past ten days.

Vacuum oil is being advertized all over the West, and as soon as I receive the "right" promised by Mr. Toppan, I shall pitch into the parties selling. I wrote to Mr. Claflin, but as yet have received no response.

Mr. Bartlett will not sell tanners' oil and interfere with you, nor will I sell to other parties so as to conflict in any way with your trade.

Yours, very truly,

HERBERT W. C. TWEDDLE.

EXHIBIT No. 83.

Eclipse neutral topaz oil. Notice from the Eclipse Petroleum Refinery, Pittsburgh.

In regard to any suits brought against consumers or dealers in my neutral topaz oil, for infringement of any letters-patent of Joshua Merrill or the Downer Kerosene-Oil Company, I undertake to defend such suits, and to guarantee the defendants against any costs or damages recovered against them in such suits, provided they place their defence in the hands of my counsel, Messrs. Bakewell & Christy, of Pittsburg, or Causten Browne, esq., of Boston, and notify me thereof.

HERBERT W. C. TWEDDLE.

J. R. BARTLET,
General Agent, 127 *State street, Boston.*

384 To dealers and consumers of Eclipse neutral topaz oil, and to all others whom it may concern:

It having come to my notice that for some time past the Downer Kerosene-Oil Co. have repeatedly made threats of intimidation against my customers, viz, that they would institute suits against them for the supposed infringement of some of their patents, in the purchase and use of my oils, this is to notify all parties who may buy, sell, or use my products, that I will protect them in the free use of the same.

These oils are manufactured under patents granted to me, and in no wise infringe the rights of any one.

They prove superior in every respect to the Downer Co.'s oil, or any

other product of petroleum, which is doubtless the reason of the threats of intimidation so freely uttered of late by the aforesaid Downer Kerosene-Oil Co.

H. W. C. TWEDDLE,
Eclipse Petroleum Refinery, Pittsburg, Pa.

J. R. BARTLETT,
127 *State street, General Agent*
For the Eclipse Works of Penna.

Eclipse neutral topaz oil. Notice from the Eclipse Petroleum Refinery, Pittsburg.

In regard to any suits brought against consumers or dealers in my neutral topaz oil, for infringement of any letters-patent of Joshua Merrill or the Downer Kerosene-Oil Company, I undertake to defend such suits, and to guarantee the defendants against any cost or damages recovered against them in such suits, provided they place their defence in the hands of my counsel, Messrs. Bakewell & Christie, of Pittsburgh, or Causten Browne, esq., of Boston, and notify me thereof.

HERBERT W. C. TWEDDLE.

J. R. BARTLETT,
General Agent, 127 *State street, Boston.*

385 *Deposition of William H. Howard, taken, subscribed, and sworn to before J. H. Bailey, esq., examiner, June* 16, 1871.

Direct examination by Wm. Bakewell, esq., of counsel for respondent:

Met at same place, pursuant to adjournment.

Present, counsel of the respective parties and Mr. Merrill.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is William H. Howard, my age is thirty years, my residence is in Allegheny City, State of Pennsylvania, and my occupation is oil manufacturer and dealer.

Int. 2. Are you acquainted with Dr. H. W. C. Tweddle, and how long have you known him?

Ans. I have been acquainted with him over seven years.

Int. 3. Have you dealt at all in petroleum lubricating oils?

Ans. Yes, sir.

Int. 4. How long have you been in business for yourself and with whom, if at all, were you engaged before going into business for yourself?

Ans. I have been engaged for the last eighteen months for myself, previous to which I was with James Dalzell & Sons, in the oil-business.

Int. 5. State what business James Dalzell & Sons were engaged in while you were with them.

Ans. Oil manufacturers and merchants.

Int. 6. State, while with James Dalzell & Sons, whether they had any dealings in lubricating oils, not petroleum oils, mixed with paraffine oils.

Ans. They had.

Int. 7. Did you know Dr. Tweddle's neutral topaz oil?

Ans. Yes, sir.

Int. 8. State whether you have dealt in it, and did Dalzell and Sons deal in it or use it.

Ans. I have dealt in it, and so did James Dalzell and Sons; both parties have used it.

386 Int. 9. State for what purpose it was used by James Dalzell and Sons and by you.

Ans. The principal use it was applied to was compounding with other oils.

Int. 10. State with what oils it was compounded and for what purpose.

Ans. It was compounded with fatty oils, for lubricating purposes.

Int. 11. Previous to the use of Dr. Tweddle's neutral topaz oil by you and Dalzell and Sons, for the purposes you have named, had you used or tried to use any other paraffine lubricating or other heavy paraffine oils for the same purposes?

Ans. We had tried other paraffine oils for those purposes.

Int. 12. With what success?

Ans. No success.

Int. 13. Were these other heavy paraffine oils which you tried objectionable for the purposes referred to. And, if yea, state why.

Ans. They were objectionable, on account of color and smell.

Int. 14. Describe the color which you refer to as being objectionable.

Ans. I would describe it as a bluish green.

Int. 15. State what was the character of Tweddle's neutral topaz oil in respect to the color and smell.

Ans. Well, it was not objectionable on account of color and smell as other paraffine oils had been.

Int. 16. When did you first see any sample or samples of the oil you have referred to as Tweddle's neutral topaz oil?

Ans. In the fall of 1867.

Int. 17. Where did you see it and who showed it to you?

Ans. Dr. Tweddle showed it to me at the Eclipse Works, at or near the Sharpsburg bridge.

Int. 18. Do you recollect in what condition the buildings at the Eclipse Works at the Sharpsburg bridge were at the time when Tweddle showed you the sample of oil referred to in your last answer?

Ans. The works were being built at that time; part of them had been built.

Int. 19. Were any of the buildings in an incomplete state at that time?

387 Ans. Yes, sir; at that time I recollect of the carpenters working at a building alongside of the railroad-track. For what use it was intended I don't recollect. I recollect I was in the building.

Int. 20. How did the sample of oil which he then showed you correspond or compare with the Tweddle neutral topaz oil, as it is now known in the market?

Ans. It was the same, to all practical purposes. It may have varied in color somewhat.

Int. 21. About what color was it?

Ans. Well, it is best described as topaz color; the name describes it best.

Int. 22. What did Dr. Tweddle say to you, if anything, at that time, in regard to the introduction of that oil into market?

Ans. He asked me its commercial value, what quantity could probably be sold, and to what use it could be applied. I presume we probably had an hour or maybe two hours conversation in regard to it.

Int. 23. What did you tell him in regard to these matters?

Ans. I told him that almost any quantity could be sold if prices were satisfactory. The sales would be mostly for compounding purposes.

Int. 24. State whether or not you, at that time or afterwards, procured any sample or samples of that oil; and, if so, for what purpose and with what results.

Ans. At or about that time I took samples for the purpose of mixing with fatty oil, to see the result, which was favorable.

Int. 25. State whether or not you, or the firm with which you were connected, purchased any of Tweddle's neutral topaz oil; and, if yea, about what time you or they first made such purchase.

Ans. We did purchase. It was in 1868. I could not locate the date very early. I could not locate the date with precision at all.

Int. 26. About what time in the year 1868 was it, as near as you can recollect?

Ans. It was in summer—in warm weather.

Int. 27. Do you know for what purpose that oil was purchased or what became of it?

Ans. It was purchased for the purpose of mixing with fatty oils. I refer to the first purchase, and this was done.

388 Int. 28. State, if you recollect, whether this oil which was purchased from Dr. Tweddle about the summer of 1868 had or had not paraffine in it.

Ans. That would be very hard to tell, because in the summer that could not be told except by testing.

Int. 29. State whether or not you, or the firm with which you were connected, made further purchases after the time of the first purchase of this oil from Dr. Tweddle.

Ans. Both firms did.

Int. 30. About the sales of this oil from that time, state whether or not you continued to purchase and sell oil.

Ans. Yes, sir; have continued to purchase and sell with intermissions.

Int. 31. You speak of intermissions. Do you recollect or can you state what occasioned them?

Ans. Well, the fire by which the Eclipse Works were destroyed occasioned one intermission. Sometimes we could not get the oil when we wanted it.

Int. 32. State how their oil was received in the market; whether favorably or otherwise?

Ans. Favorably received.

Int. 33. When you could not procure the Tweddle neutral topaz oil, what, if anything, did you do to supply its place?

Ans. Well, we tried to get oil to supply its place, but failed to do so.

Int. 34. About what time, particularly, did you make an effort to supply the place of Dr. Tweddle's?

Ans. Last summer, the summer of 1870.

Int. 35. At that time, the summer of 1870, were you in business on your own account?

Ans. With my brothers; I was directly interested in the firm.

Int. 36. At that time—the summer of 1870—what other oils, if any, did you try for the purposes for which you used the Tweddle neutral topaz oil?

Ans. We tried a great many. I recollect Morehouse, Merriam and Company's oil, of Cleveland, and Downer oil, of Corry, and another Cleveland oil that we tried.

Int. 37. Do you know what the Downer oil was called?

389 Ans. I have heard it called the Merrill oil and the Corry oil.

Int. 38. From whom did you purchase the Merrill oil?

Ans. We did not purchase. Samples were left with us.

Int. 39. Why did you not purchase the oil referred to, which you heard called the Merrill oil?

Ans. Because it did not suit our purpose.

Int. 40. Did you try the samples of the Merrill oil left with you? If yea, what was the result?

Ans. We tried it compounded with fatty oils. It colored the oil too much for our use.

Int. 41. What color do you refer to in your last answer?

Ans. Blue.

Int. 42. State, if you know, from whom you procured the samples of the oil which you heard called Merrill oil.

Ans. From a party who wished to sell. Who the party was I don't know. He was sent to us by Isaac M. Pennock, who knew we wanted an oil to take the place of the topaz.

Int. 43. State whether or not this person referred to, who furnished you with samples of this oil, stated himself to be the agent or representative of any manufacturer, firm, or company; and, if yea, of whom.

Ans. He represented himself as from the Downer Oil Company, of Corry.

Int. 44. State whether or not you have sold any of the Tweddle neutral topaz oil unmixed with other oils, and for what purpose, if you know.

Ans. We have sold it for light lubricating.

Int. 45. What do you mean by light lubricating?

Ans. Where the bearings or friction is light.

Int. 46. State for what kind of machinery, if you know.

Ans. I know of having sold it to cotton-mills. I don't recollect anything else.

Int. 47. State, as near as you can, about the gravity of the Tweddle neutral topaz oil which you have spoken of in this deposition.

Ans. Thirty-four to thirty-eight. I think we have had it as low as thirty-four. I know we have had it as high as thirty-eight.

390 Cross-examination:

Cross-int. 1. Where is your place of business and what is the name of your firm?

Ans. No. 27 Seventh street, Pittsburgh. W. H. Howard and Company.

Cross-int. 2. Where is the place of business of Dalzell and Sons?

Ans. 69 and 70 Water street, Pittsburgh.

Cross-int. 3. You speak of your firm and of the firm of Dalzell and Sons, while you were with it, as oil-manufacturers. What branch or branches of the oil-manufacturing business do you carry on? What kinds of oil do you make and sell?

Ans. Manufacture lard oil. We sell petroleum, lubricating, and burning oils, and compounded oils.

Cross-int. 4. What kind of fatty oils did you use compounded with neutral topaz oil?

Ans. Lard oil.

Cross-int. 5. Were you in the habit of visiting often Dr. Tweddle's refinery, at Sharpsburg bridge?

Ans. I was.

Cross-int. 6. You speak of having tried paraffine oils to mix with other oils before you used Dr. Tweddle's oil, and with no success. What kind of paraffine oils did you refer to then?

Ans. What was ordinarily denominated paraffine oil at the time.

Cross-int. 7. Can you name the manufacturers who produced them?

Ans. I cannot recollect the name of any at that time.

Cross-int. 8. You speak of seeing some of Dr. Tweddle's neutral topaz oil at his refinery, at Sharpsburg bridge, in the fall of 1867. How much of it did you see?

Ans. I saw only what the doctor showed me in a bottle at that time.

Cross-int. 9. Did you make any memorandum at the time of what you saw and of the conversation between you and the doctor, and of the time of the conversation?

Ans. I had no memorandum of the conversation, and had a diary for that year, and have lost it; at least I can't find it. I made no memorandum of what I saw or of the time.

391 Cross-int. 10. You speak, then, entirely from recollection of those circumstances?

Ans. No, not entirely; circumstances occurring at that time keep it fresh in my memory; otherwise, I would not remember the time or the circumstance.

Cross-int. 11. Have you any memoranda of those other circumstances to which you refer?

Ans. Yes.

Cross-int. 12. Made at the time?

Ans. At or about the time.

Cross-int. 13. What are they?

Ans. Notes given by an uncle to a grandfather, and the further fact that my uncle occupied the house on the lot owned by Dr. Tweddle; and my grandparents occupied a house within two moments' walk of the Eclipse Refinery, and I had visited very often for purpose of closing business matters between my uncle and grandfather.

Cross-int. 14. What had the giving of those notes to do with the examination of that oil and the conversation with Dr. Tweddle?

Ans. Nothing further than that they brighten my recollection as to time.

Cross-int. 15. What did the doctor call the oil he showed you at that time?

Ans. I do not remember.

Cross-int. 16. You say you told him it could have a large sale, if prices were satisfactory. What prices did you think would be satisfactory?

Ans. I do not remember.

Cross-int. 17. Do you remember what price you paid for the oil in the summer of 1868?

Ans. I do not.

Cross-int. 18. Do you remember what amount you purchased at that time?

Ans. I do not.

Cross-int. 19. Do you remember under what name you purchased it?

Ans. Am not positive; presume it was topaz; am not sure.

Cross-int. 20. When did you make your next purchase?

Ans. After the first purchase, which proved satisfactory, we
392 purchased off and on just as we needed it. I cannot remember the date of any purchase.

Cross-int. 21 Did you make other purchases during 1868?

Ans. I presume we did; I am not positive. The first purchase may have been late in the year or it may have been large enough to have lasted us through the year.

Cross-int. 22. Do you recollect how many purchases you made during 1869?

Ans. No, sir.

Cross-int. 23. Do you recollect that you made any?

Ans. As we continued to use the oil, I presume we did; we could not have done otherwise.

Cross-int. 24. I am asking if you recollect, not what you presume.

Ans. I recollect of having purchased and used the oil in 1869; cannot locate any one date.

Cross-int. 25. Do you recollect the price or prices you paid in 1869?

Ans. The price varied from forty-five to fifty-five, if my memory serves me correctly.

Cross-int. 26. You mean per gallon?

Ans. Yes.

Cross-int. 27. Can you give us any idea of the quantity you purchased or used in the year 1869?

Ans. Could not possibly do so without reference to the books. If the books were here, I could.

Cross-int. 28. You left the firm of Dalzell and Sons, if I understand it, about the latter part of 1869 or the early part of 1870?

Ans. Left Dalzell and Sons in September, 1869.

Cross-int. 29. When did you form your new company?

Ans. In August, 1869.

Cross-int. 30. Can you tell what purchases the new company made between the time of its formation and the time of the destruction of Dr. Tweddle's refinery at the Sharpsburg bridge?

Ans. I could not say positively; probably one hundred barrels.

Cross-int. 31. Do you recollect the prices you paid during that period?

Ans. Fifty cents per gallon, I think, was the price at that time.

393 Cross-int. 32. In the 32d interrogatory, how this oil was received in the market, and you answer "favorably;" do you refer here to the oils compounded with the 'opaz oil, or to the pure topaz oil itself, or to both?

Ans. To both.

Cross-int. 33. When you sold the compounded oil you informed the purchasers, I suppose, that it was a compound of lard-oil and topaz oil?

Ans. We informed them frequently that it was a compound. They bought it usually as such. It was none of our business to tell them what it was a compound of.

Cross-int. 34. You say that after the destruction of Dr. Tweddle's Eclipse Works you had a sample of oil from the Corry Works; how much did you have?

Ans. About a gill. I suppose the bottle would hold that quantity.

Cross-int. 35. You did not have enough then to compound with other oil, and to offer the compound for sale to your customers?

Ans. No, sir.

Cross-int. 36. The objectionable color, then, you refer to, was objectionable only to yourselves?

Ans. That was all; we went no farther with it.

Cross-int. 37. Why was the color objectionable to yourselves?

Ans. It would allow other parties to believe there was paraffine oil in the compound, which we would not wish them to know.

Cross-int. 38. Why should not you wish them to know there was paraffine oil in it, as long as it was true?

Ans. Simply because they could make the same oil, and probably undersell us in price, using a cheaper paraffine oil.

Cross-int. 39. What kind of paraffine oil could they have obtained which was cheaper in price?

Ans. They could have obtained what is commonly called paraffine oil, which is about two-thirds the price of neutral topaz.

Cross-int. 40. Well, would a compound of such oils have been as good for lubricating purposes as a compound with neutral topaz?

Ans. There is a difference of opinion among the public on that.

394 I believe the neutral topaz to be a better lubricator than the ordinary paraffine oil.

Cross-int. 41. If you were selling directly to a consumer, would this color you have referred to have been objectionable?

Ans. It would, if the consumer would go to the trouble to look at the oil.

Cross-int. 42. Would he have objected to the color if satisfied with the lubricating qualities of the oil?

Ans. No.

Cross-int. 43. Did you deal with consumers?

Ans. We do.

Cross-int. 44. Did you find the Corry oil objectionable for any other reason than the color?

Ans. No other objection to it.

Cross int. 45. There could have been no objection then to using that oil to sell directly to your customers, who are consumers?

Ans. No; to those who used it pure. When compounded we would not have risked the selling of it to our consumers.

Cross-int. 46. Why not, if there was no objection, except to the color?

Ans. Simply on color. Object to it only on the color.

Cross-int. 47. But I understood you that consumers did not object to color, if the lubricating qualities were satisfactory, and as in every other respect, except as to color, there was no objection to the Corry oil, why should you not have dared risk it with consumers?

Ans. I believe I answered that question by stating that paraffine oil would be charged as being in it.

Cross-int. 48. But the consumers would not care for that if it was satisfactory for the purposes for which they were buying, and they were paying a fair price for what they were buying?

Ans. Other dealers seeing the oil would offer a compounded paraffine oil at less than we could afford to give the neutral topaz compound.

Cross-int. 49. And did you believe yourself and the firm of Dalzell and Sons to be the only compounders of lard oil with paraffine oils in the country or in this market?

Ans. I believe we were the only compounders in this market. I never knew any other to be offered.

395 Cross-int. 50. You knew of its being offered in other markets, didn't you?

Ans. Yes.

Cross-int. 51. It was no secret in the trade, was it, that fatty oils were often mixed with the common paraffine oils?

Ans. No; it was no secret in the trade.

Cross-int. 52. Will you examine the samples marked "Exhibits Nos. 65 and 64," and state how they compare with the samples you were shown of the Corry oil?

Ans. There would be no use of opening these, as I could not tell unless they were put in bottles, so as to judge of the color.

Cross-int. 53. Did you examine this Corry oil with reference to any other quality except color?

Ans. I did not.

Cross-int. 54. During the time Dr. Tweddle was refining oil at his refinery at Sharpsburg bridge, did you purchase and sell his illuminating oils?

Ans. No, sir.

Cross-int. 55. You would have no objection, I suppose, if Mr. Merrill or his counsel should hereafter desire to obtain any information with respect to your purchases of neutral topaz oil or the purchases of Dalzell and Sons, from Dr. Tweddle, to communicate freely with them and give them all the information in your power?

Ans. No objections whatever; would do so freely. Any information I have I will give them.

WILLIAM H. HOWARD.

396 *Deposition of Joseph C. George, taken, subscribed, and sworn to before J. H. Bailey, esq., examiner.*

Called by respondent, and, being duly sworn, deposes as follows:

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Joseph C. George. My age is forty-one years. My residence is in Sharpsburg, Alleghany County, Pennsylvania; and my occupation is carpenter.

Int. 2. How long have you been in that business?

Ans. Over twenty years.

Int. 3. Did you have anything to do with the erection of Dr. Tweddle's oil-works at the Sharpsburg bridge?

Ans. Yes, sir.

Int. 4. When was the erection of them commenced?

Ans. About the first of March, 1867, I commenced. They had been working there for some time in January before I went.

Int. 5. Were you employed in the erection of those works, and in what capacity?

Ans. I was employed as carpenter, superintending the carpenter-work.

Int. 6. Did you superintend the construction of the large warehouse at those works? And, if so, state when it was built.

Ans. I superintended the construction of the large warehouse. It was built in the spring, summer, and fall of 1867. I was six or seven months there right along, working at that and other carpenter-work. There was a part of the floor laid in 1868.

Int. 7. About how large was that warehouse?

Ans. Eighty-seven feet and some inches front, by one hundred deep, and two stories high.

Int. 8. Did you construct or erect any presses at those works?

Ans. Yes, sir.

Int. 9. State by whose directions and what they were for.

Ans. By the direction of Dr. Tweddle. They were to be used for pressing oil.

397 Int. 10. Describe the construction of those presses.

Ans. They were first started with sills in the ground; upright posts, eight by eight inches square, four to each press, with caps on top of them to hold them to their place. There were levers that were used at first for pressing; these were about sixteen by twenty inches, and twenty-four feet long. There were boards used for putting the oil on, about two feet four inches wide by four feet eight inches long; after they had used the levers, they found they could not get weight enough and they used hydraulic jacks.

Int. 11. How were the presses bolted together?

Ans. With iron bolts running up through the whole height of the press. They were pretty near sixteen feet high.

Int. 12. When were these presses commenced to be erected and how many did you put up at first?

Ans. In the fall of 1868 we put up two.

Int. 13. How many did you put up afterwards and how soon after the others?

Ans. I put up three others, just shortly after we got the two finished. It was in the same winter. In the winter of 1869 I put up three others, making eight in all.

Int. 14. When were the first presses completed, and how soon after completion were they first used, if you know?

Ans. They were completed about the time the cold weather first set in. They were hurrying them up, because they wanted to use them when the cold weather set in. They were used almost as soon as they were put up; they were used before they were altogether finished, before we got the floor down and the covering over them.

J. C. GEORGE.

Adjourned to meet June 27th, 1871, at 10 o'clock a. m., at the same place.

398 JUNE 27TH, 1871.

Met, pursuant to adjournment, at the same place.

Present, C. Smith, esq., of counsel for complainant, and W. Bakewell, esq., for respondents, and Mr. Merrill.

Deposition of Robert Hill, taken, subscribed, and sworn to before J. H. Bailey, esq., examiner.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Robert Hill; my age is sixty-six years; my residence is in Pittsburgh, State of Pennsylvania; and my occupation is proprietor of planing-mill.

Int. 2. Where is your planing-mill situate and how long have you been in that business at that place?

Ans. My mill is on the corner of 26th and Penn streets, city of Pittsburgh. I think we built the mill in 1851, and we have been in business there ever since.

Int. 3. Are you acquainted with Dr. Tweddle, and how long have you known him?

Ans. I suppose it may be nine years since I became acquainted. I am not certain, but it is some considerable time since I became acquainted with Dr. Tweddle.

Int. 4. State whether or not you recollect Dr. Tweddle bringing you some oil to try on your machinery? If yea, state the time as near as you can recollect.

Ans. I remember him bringing me some. To the best of my recollection it was in the summer of 1867.

Int. 5. About what time in the summer, as near as you can fix it?

Ans. From June to August.

Int. 6. State how you fix that date.

Ans. By my books.

Int. 7. State how you fix it by your books.

Ans. I was manufacturing some siding for Dr. Tweddle's warehouse at Sharpsburg bridge at the time.

Int. 8. State what quantity of oil he brought you and in what the oil was contained, if you recollect.

399 Ans. I was getting some green oil previous to that time from him, and he came in with a vial of another kind that day, or about that time.

Int. 9. State what he wanted you to do with that oil, contained in that vial.

Ans. He wanted me to try it on the fastest machinery I had, down on the lower floor of my mill. I remarked to him that they had faster machinery up stairs, in the sash and door factory. We went up stairs and I introduced him to James Douglas, one of the partners, up stairs. Then we told Mr. Douglas our errand up. The doctor then, I think, produced the vial of oil. I seen him and Douglas going to the journals and putting the oil on. I think, then, to the best of my knowledge, I went down stairs, and left the doctor and him there.

Int. 10. What description of machines did they have up-stairs in McKee and Douglas' shops?

Ans. They had moulding-machinery, a circular and a cross-cut saw. To the best of my knowledge, it was on the moulding-machinery, and may be on the circular saw, that they tried the oil.

Int. 11. What description of oil was it the doctor brought in the vial that was tried on the McKee and Douglas' machinery?

Ans. I called it machinery oil, a light yellow.

Int. 12. Did you understand from what the oil was made?

(Objected to by counsel for complainant, as calling for hearesay testimony.)

Ans. I can't state that altogether. I did not examine it much, only as to color, and seeing them using it.

Int. 13. What was the smell of the oil, if you know? State whether it had much or little smell.

Ans. I cannot recollect that. I don't remember whether I smelled it at all or not. I might, but don't recollect.

Int. 14. Did you afterwards learn from Douglas how this oil answered on his machinery?

(Objected to by counsel for the complainant, as being leading and calling for hearsay testimony.)

Ans. Yes, sir.

Int. 15. State what you learned from him.

(Objected to, as calling for hearsay testimony.)

Ans. He told me that he had been getting oil from different

400 places before, and that this oil was the best he ever got, and he would not want any other than this, if he could get it.

Int. 16. State whether or not the firm of McKee and Douglas are still in business in this city.

Ans. Yes, sir; not in my place though.

Int. 17. When did you see James Douglas last?

Ans. Yesterday, at half-past five o'clock. Mr. Douglas met with a very severe accident, shortly after I saw him, and it is very doubtful whether he will live.

Cross-examined by C. Smith, esq., of counsel for complainant.

Cross-int. 1. You used a considerable quantity of Dr. Tweddle's green lubricating oil, did you not?

Ans. No, not very much; a barrel occasionally.

Cross-int. 2. Do you recollect the price you paid for it in 1867 and 1868?

Ans. I think from ten to fourteen dollars a barrel.

Cross-int. 3. You gave the doctor a certificate as to its value in the spring of 1868, did you not?

Ans. I think I did.

Cross-int. 4. Will you look at the certificate at the top of page 381 of the printed record, and state if that is the certificate you gave?

Ans. I think it is.

Direct resumed.

Int. 18. Do I understand you that the certificate you have just referred to had reference to the green lubricating oil you spoke of in your answer to the eighth interrogatory?

Ans. I think so. I never used any other kind from the doctor than that kind, to the best of my recollection, on account that it was cheaper than this other kind.

Int. 19. Did the doctor, when he brought the yellow oil to your shop, state anything about the price of it? If so, what?

Ans. I think he did. I think he said eighty or eighty-five cents a gallon.

Int. 20. Then I understand you that you never yourself used the doctor's yellow oil on your machinery; am I right?

401 Ans. Yes, sir; you are right.

Int. 21. Do you know whether or not this yellow oil of Dr Tweddle's was used by McKee and Douglas, on their machinery, after the time the doctor brought it there in a vial, as you have stated, and while they occupied a shop up stairs in your planing-mill?

Ans. Well, by what they told me, they did. I don't know it of my own knowledge.

ROBERT HILL.

Adjourned till 4.30 p. m. this day.

4.30 p. m.

Met pursuant to adjournment.

Present, as at the morning session.

Deposition of Archibald Kelly, taken, subscribed, and sworn to before J. H. Bailey, esq., examiner.

Called upon the part of the defendants, and, being first duly sworn, deposeth as follows:

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Archibald Kelly; my age is about sixty-two years; my residence is Sharpsburg, Alleghany County, Pennsylvania, and I am in the saw-mill business.

Int. 2. Where did you live in the year 1866?

Ans. In Collins Township, Alleghany County, Pennsylvania, near the end of the Sharpsburg bridge.

Int. 3. How long did you continue to live there?

Ans. I lived there till the spring of 1868, March, I think.

Int. 4. Did you dispose of that property? to whom, and when?

Ans. I sold to Dr. Tweddle, in October, 1866.

Int. 5. For what purpose did he purchase that property?

Ans. He commenced putting up a large storing-tank for crude oil for the purpose of putting up a refinery. He commenced in December, 1866.

Int. 6. State whether or not Dr. Tweddle erected his refinery on that property—what buildings he put up and when.

402 Ans. Dr. Tweddle commenced at that time—right away in December, 1866—and put up a machine-shop; built the house

for the still; put up a cast iron still; put some more tanks up outside, and boilers; put up a warehouse the summer of 1867.

Int. 7. Do I understand you that you continued to reside on that property after you sold it to Dr. Tweddle, in October, 1866?

Ans. Yes, sir.

Int. 8. Have you had anything to do with the refining of petroleum yourself?

Ans. Yes, sir. I was in the business five years, at the Anchor refinery, which was on the bank of the Alleghany River, near Pittsburgh, about a quarter of a mile below the Shaftsburgh bridge, until January, 1868.

Int. 9. What process of distillation was used at the Anchor refinery while you were there?

Ans. It was the old style, by putting the fire right under the still.

Int. 10. You have spoken of Dr. Tweddle putting up a cast-iron still between December, 1866, and the summer of 1867. Will you state about what time?

Ans. It was in the spring of 1867 that he put up the still.

Int. 11. What description of still was it and how was it operated?

Ans. It was of a round shape, with pipes all through it, gas-pipes, operated by steam and superheated steam.

Int. 12. State whether or not there was fire applied to the still.

Ans. Not while I saw it running. There was a furnace underneath. It was steam that was applied to it when I saw it.

Int. 13. Are you sure there was a furnace under that still?

Ans. Well, no, I can't be sure. There was an opening at the back end. There was no furnace under that still; it was an opening, that I have reference to.

Int. 14. State whether or not that still is in existence yet, and when you last saw it.

Ans. I saw it about two weeks ago, I think. I can't remember the date.

Int. 15. State whether or not Dr. Tweddle's works at the Sharpsburgh bridge, which you have referred to, are in operation yet.

403 Ans. No, sir; they are not in operation yet. They were burned down.

Int. 16. State what other apparatus, that you know of, that was used by Dr. Tweddle in connection with his still.

Ans. He used an air-pump.

Int. 17. State for what purpose.

Ans. For creating a vacuum for distilling purposes.

Int. 18. You have spoken of the use, in connection with that still, of steam and superheated steam. State if you know how the steam was superheated.

Ans. By a furnace, sitting right alongside of the still, with a wall between them at that time.

Int. 19. About what time did Dr. Tweddle commence using this apparatus or still, and vacuum-pump, and steam and superheated steam?

Ans. It was in 1867, the latter part of May or the first of June, some time.

Int. 20. Did you observe the products of distillation by the use of this still?

Ans. Yes, sir.

Int. 21. What were they?

Ans. The color seemed a little different; there was none of that blue tinge that there is in the usual process.

Int. 22. What kind of oils were they?

Ans. There was burning oil that came off first, then an oil of an amber color, which we called the lubricating oil. The burning oil was an oil, like any of our burning oils, except that it had none of that green tinge or color. The lubricating oil was an amber color, a little milky when coming off the still.

Int. 23. What was the character of the residuum in the still after the illuminating and amber-colored lubricating oils came off?

Ans. Dark green; dirty green, I call it.

Int. 24. State whether or not the oil in the still had any coke in it after the illuminating and amber-colored lubricating oil had been taken over.

Ans. Well, I think not. I never was in the still at that time.

Int. 25. What was the character of the odor or smell of the
404 amber-colored lubricating oil which you have spoken of as produced by Dr. Tweddle's process?

Ans. It had a smell, but not so much as that done in the old way of distilling. All petroleum has a smell. To give the difference between the two, the one has a scorched-burnt smell and the other hasn't.

Int. 26. Which has the scorched-burnt smell and which has not; that made by Dr. Tweddle's process or that made by ordinary fire-distillation?

Ans. That made by the ordinary fire-distillation has the burnt smell.

Int. 27. State whether or not Dr. Tweddle put up other stills after the one you have referred to, at those works, when, and how many?

Ans. In 1867, I think, he put up two more, and one more after that.

Int. 28. What part of the year 1867?

Ans. It was in summer, some time.

Int. 29. You have stated that you lived on that place until March, 1868; who occupied the house after you left it?

Ans. Dr. Tweddle's family.

Int. 30. You stated that the amber-colored lubricating oil made by Dr. Tweddle's process did not have the scorched-burnt smell of fire-distilled oils; to what do you attribute this difference?

Ans. By the one using steam and the other by fire underneath the still.

Int. 31. You have spoken of the oil running from the still by Dr. Tweddle's process after the illuminating oil, and which you called amber-colored lubricating oil, as being milky in appearance when running from the still. State, if you know, what is the cause of this milky appearance?

Ans. Well, I might be wrong about my ideas about the matter. I attribute it to the steam.

Int. 32. You have spoken of the amber-colored oil as lubricating oil; state whether you have ever used it for that purpose?

Ans. Yes, sir. I used it in 1867 and I have been using it for two years back.

Int. 33. In what way did you use it in 1867 and where?

Ans. At the Anchor refinery, on our pumps; and since that
405 time I have used it on a circular saw, and on our engine, at my own saw-mill at Sharpsburg.

Int. 34. State how it answered as a lubricator when you used it on your pumps at the Anchor refinery in 1867.

Ans. It gave good satisfaction.

Int. 35. How did it answer in your subsequent use of it at your saw-mill during the last two years.

Ans. Very well.

Int. 36. In what parts of your circular saw and engine at your saw-mill have you used it?

Ans. On the journals, where they run from twenty-five hundred to three thousand revolutions per minute.

Int. 37. You have spoken of the dark-green colored oil, remaining in the still, as used by Dr. Tweddle, after the illuminating oil and the amber-colored lubricating oil was carried over. State, if you know, what this heavy green oil was used for.

Ans. They made paraffine out of it.

Int. 38. State whether you have seen any paraffine made by Dr. Tweddle.

Ans. Yes, sir.

Int. 39. State how he made it.

Ans. He chilled the residuum and pressed it out.

Int. 40. Are you sure that it was the dark-green residuum which Dr. Tweddle pressed to produce his paraffine?

Ans. No, it was not the dark; it was more of a lighter color. What stage that came off, I could not state correctly.

Int. 41. In what way did Dr. Tweddle press his oil?

Ans. He put it in inside of cloth and put it between presses, with boards or sheet-iron.

Int. 42. What was the appearance of the paraffine after the oil had been pressed out of it?

Ans. It resembled beeswax, only lighter in color.

Int. 43. When did Dr. Tweddle build the warehouse which you have spoken of, at his refinery, at the Sharpsburg bridge?

Ans. It was in 1867.

Int. 44. Do you recollect in what part of the year?

Ans. I think it was towards the fall, some time.

406 Int. 45. Did Dr. Tweddle, at any time, speak to you about organizing a company for the manufacture of his oils?

Ans. Yes, sir; he spoke to me in 1867—in the winter of 1867?

Int. 46. Did you propose going into the company when it was formed?

Ans. Yes, sir.

Int. 47. Did you do so?

Ans. No, sir; I did not. The company was not formed.

Adjourned till 10 a. m. to-morrow.

JUNE 28, 1871.

Met pursuant to adjournment, at time and place designated.

Present, counsel and party, as at last meeting.

Direct examination resumed:

Int. 48. You have stated in your examination yesterday evening that Dr. Tweddle used the dark-green residuum oil for getting paraffine; state how he got the paraffine from that oil.

Ans. He could do it by a second distillation.

Int. 49. You say that he could do it by a second distillation; do you mean that he did do so?

Ans. I don't know, indeed. I could not say that.

Int. 50. Then when you spoke of his using it for that purpose, what did you mean?

Ans. It was done at other refineries.

Int. 51. I understand you that you do not know, of your own knowledge, whether or not Dr. Tweddle actually used the residuum for that purpose; is this so?

Ans. I do not know. By making that statement last night, I found, on reflection, that I had made a mistake.

Int. 52. State whether or not you have seen Dr. Tweddle press oil for the production of paraffine.

Ans. Yes, sir.

Int. 53. Did you see the paraffine after it was expressed from the oil by Dr. Tweddle?

Ans. Yes, sir.

407 Int. 54. You have spoken of the oil which you called amber-colored lubricating oil, as you saw it running from the still, as having a milky appearance. State, if you know, whether or not that appearance continued.

Ans. It got clear by the process of bleaching, by exposure to the air.

Int. 55. State, if you know, in what way or in what apparatus this oil was exposed to the air.

Ans. It was in large tanks built outside, lined with tin, I think.

Int. 56. About what depth were those tanks?

Ans. From a foot to two feet, I think. I never measured them.

Int. 57. Look at the bottle now show' to you, and state whether or not it corresponds with any of the oil which you saw made by Dr. Tweddle in the year 1867.

Ans. Yes, sir. That is about the same. The same smell precisely.

Int. 58. Which oil do you refer to as being like the sample?

Ans. This is like the oil they run from the paraffine in the pressing operation.

Int. 59. You have stated it has the same smell precisely. State whether or not it corresponds in color.

Ans. Yes, sir.

(The bottle and contents shown witness, marked "Defendant's exhibit No. 84, J. H. B.)

Int. 60. You have stated that this oil in Exhibit No. 84, J. H. B., corresponds with the oil that ran from the presses. Do you recollect about what time Dr. Tweddle began to use his presses?

Ans. I could not be positive as to that.

Int. 61. Was it before or after you left the house on the property at the Sharpsburgh bridge, in March, 1868?

Ans. I think it was before I left.

Int. 62. You have stated that the oil in Exhibit No. 84, J. H. B., is similar to the oil which you saw come from the presses. State how it corresponds, if at all, with the oil which you call amber-colored lubricating oil, as it came from the still, in 1867.

Ans. This is about the same. Some of it was a little darker color.

Int. 63. How about the odor or smell?

Ans. They smell the same.

408 Int. 64. State, by the ordinary process of fire-distillation, such as was in use at the Anchor Works, what was the character of the contents of the still after the distilling operation was finished?

Ans. There was the residuum, and then there was a cake, next to the still, of hard substance.

Int. 65. What is that residuum mentioned in your last answer usually called by distillers?

Ans. Tar.

Int. 66. What was the cake or hard substance called?

Ans. It was called a coke. I don't know that there was any particular name for it.

Int. 67. State what is usually done with this tar or residuum of fire-distillation.

Ans. I ran it to the river. I have run thousands of barrels into the river. Sometimes you could get fifty cents a barrel for it.

Int. 68. What was done with the hard substance?

Ans. It was thrown away; sometimes burned.

ARCHIBALD KELLY.

Deposition of Valentine Holler, taken, subscribed, and sworn to before J. H. Bailey, esq., examiner.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Valentine Holler; my age is twenty-four years; my residence is at Aladdin, Armstrong County, Pennsylvania, and my occupation is foreman of the warehouse of Dr. Tweddle's Aladdin Oil Works.

Int. 2. Were you in Dr. Tweddle's employ at the old Eclipse Works, at the Sharpsburg bridge?

Ans. I was.

Int. 3. When did you go into Dr. Tweddle's employ at those works at the Sharpsburg bridge?

Ans. In 1868; in the latter part of May, 1868.

Int. 4. When were those works destroyed and how?

Ans. Just one year to-day. They were destroyed by lightning.

Int. 5. Describe as briefly as you can what the lightning struck and with what result.

409 Ans. It struck the twenty-thousand-barrel tank, full of crude oil, and bursted it. It struck it and set it on fire, and the oil washed everything ahead of it; the oil was on fire, and set the dwelling-house of Dr. Tweddle and the warehouse on fire. The whole works were burned. The clerk, Mr. Foster, was burned up in the office. Dr. Tweddle was not there till the works were all destroyed; at least they were before I saw him there. I was there in the warehouse at the time the tank was struck. I saw the bolt come down and strike the tank.

Int. 6. You have stated that you are foreman of the warehouse of Dr. Tweddle's works at Aladdin; are you acquainted with the construction and kind of distilling-apparatus in use at the old Eclipse Works in May, 1868?

Ans. No, sir; I know nothing about them whatever.

Int. 7. What was your trade or occupation at the time you went into Dr. Tweddle's works at the Sharpsburg bridge?

Ans. Cooper.

Int. 8. Did you put up or assist in putting up any paraffine-presses at the old Eclipse Works at the Sharpsburg bridge?

Ans. I assisted—helped the carpenter. Joseph George was the carpenter I assisted.

Int. 9. How long after you went there in May, 1868, was it that these presses were put up?

Ans. Between three and four months, somewhere near there. I could not exactly tell.

Int. 10. State whether these presses were used and for what purpose.

Ans. For pressing paraffine.

Int. 11. How were they worked?

Ans. Worked with levers or beams.

Int. 12. Were they worked all the while with levers or beams?

Ans. These first presses was.

Int. 13. Am I to understand by your last answer that other presses were put up?

Ans. Yes, sir; there was.

Int. 14. How many and when?

Ans. Three, in the latter part of 1868.

Int. 15. How were they worked?

410 Ans. Worked with hydraulic jacks.

Int. 16. Referring to the first presses you speak of, state how many they were and describe what was done with them.

Ans. There were two. They were used by putting paraffine in them in rags, letting a beam down on them, and letting the oil run out of it into tanks.

Int. 17. What kind of oil was it that run from the paraffine in those presses?

Ans. Neutral topaz oil was what they called it.

Int. 18. How did that oil compare in appearance, color, and smell with the oil now manufactured and sold by Dr. Tweddle under the name of neutral topaz oil?

Ans. Just the same then as it is to-day; can't see any difference in color, odor, or anything else.

Int. 19. State, if you know, whether Dr. Tweddle had any quantity of oil waiting to be pressed at the time these two first presses were put up.

Ans. About five hundred barrels.

Int. 20. In what was the oil kept at that time, before being pressed? I refer to this quantity of five hundred barrels.

Ans. It was kept in a tank first and then put into barrels.

Int. 21. Why was it put into barrels?

Ans. To expose to the weather for to chill it, and then press it.

Int. 22. What was done with the paraffine after the oil was pressed out of it?

Ans. Put in barrels first. It was then put into tanks—steamed it and pressed it.

Int. 23. What was it pressed in?

Ans. In a hydraulic press.

Int. 24. Who had charge, at the old Eclipse Works, of the refining of the paraffine?

Ans. I refined it under the instruction of Dr. Tweddle.

Int. 25. State whether or not at the time when the old Eclipse Works were destroyed by fire, a year ago, there was any refined paraffine on hand at those works; and, if yea, about how much.

Ans. Between eighty and a hundred tons refined wax.

411 Int. 26. What became of it?

Ans. I guess it burned up; I never seen it afterwards.

VALENTINE HOLLER.

Respondents' counsel gave notice to complainant's counsel that respondents propose to take and offer in evidence the testimony of James Douglas, (now lying dangerously ill, in consequence of being thrown from his buggy on the evening of Monday, 26th inst.,) as soon as his health will permit of examination, it having been their intention to take his testimony at this hearing.

With consent of complainants' counsel, Dr. H.W. C. Tweddle, who is present at this time, corrects his statement in answer to cross-interrogatory 219, where he says, "I think it was in possession of Mr. De-

camp, of this city," by stating that he now thinks that Decamp was not the name of the man he referred to, but believes the name was J. Y. McLaughlin.

The further examination of witnesses in this suit adjourned to the Hoffman House, in the city of New York, upon Friday morning next, June 30th, 1871, at 10 a. m.

JOHN H. BAILEY,
Commissioner and Examiner.

Deposition of James Douglas, taken, subscribed, and sworn to before Wm. T. Farnham, esq., notary and commissioner, Nov. 28, 1871.

Int. 1. What is your name, age, residence, and occupation?

Ans. James Douglas; somewhere between forty-two and forty-three years of age. I reside in Pittsburg, Pennsylvania. I am a carpenter and builder, and have a sash and door factory. I am a member of the firm of McKee & Douglas.

Int. 2. How long have you had a sash and door factory in Pittsburg?

Ans. It was started on the 1st of March, 1865.

Int. 3. Are you acquainted with Dr. H. W. C. Tweddle?

Ans. Yes, sir.

412 Int. 4. Did you do any work for him at your factory, and when?

Ans. Yes, sir; I worked for him from some time in January, 1867, till some time in the last of July or 1st of August, 1867.

Int. 5. What description of work was it?

Ans. Making frames and sash, doors and mouldings, and so on.

Int. 6. State, if you know, for what building that work was made.

Ans. It was made for the office and warehouse at the end of the Sharpsburg bridge, near Pittsburg.

Int. 7. State whether or not Dr. Tweddle brought any oil to your factory; and, if so, when and for what purpose.

Ans. Some time from about the 25th of April to the 9th day of May, 1867, he came into the shop and he asked me what kind of oil we were using on the machinery. I told him we had been using different kinds of oil, or from different parties, but we had a circular rip-saw that we hard to use lard-oil on; the oil that we used on other machineries we could not use on the rip-saw; she run so fast that she burned out the boxes. Dr. Tweddle said that he was making an oil that he would like me for to try, but he brought me a bottle of oil, a small bottle, a sample bottle. For to give him a fair chance, I took the mandrel of the saw out to clean it, and to clean the boxes, to give it a fair chance for to see if it would run the saw, and I found that it suited the purpose as well as the lard-oil for the saw. I sent out afterwards and got either a gallon or a two-gallon can of the same oil for to see if that it would run the saw the same that the sample that he brought me did, and I was satisfied that it would run the saw and all the balance of the machinery. I sent after it was done for a barrel, and we have used that oil ever since when we could get it. At the time that Dr. Tweddle's works was burned down we couldn't get no more of it for some time, and I did not know that he had started his works again till I was going up to Kittaning on the Valley Railroad, and I seen Dr. Tweddle's name at the Standard Oil-Works. The first time I saw him again in town I ordered a barrel of oil with him, of the same that we had got before, and we still continued to use it since.

Int. 8. When you first tried that oil from the sample-bottle that Dr. Tweddle brought you, state whether or not you gave personal attention to the running of the saw with that oil.

Ans. Yes, sir. I was very particular with it; I used it myself,
513 all that was in the bottle. Yes, sir, for to see if it would run that saw; for we had many a time, in using other oil, burned her out, and burned three or four cuts through.

Int. 9. About how fast did the saw on which you tried that oil run?

Ans. I could not positively say how fast that saw run, because when we started into business we bought another firm out, and the saw was in operation, and had been intending to get her to go slower, as she was running faster than was necessary; but when I got this oil from Dr. Tweddle we had no further trouble with it, but she still runs at the same speed at present, with what I believe to be the same oil.

Int. 10. How long did you work yourself trying the sample which Dr. Tweddle first brought you?

Ans. Pretty near a whole day, pretty near three-quarters of a day. I guess the bottle of oil run the saw without any other oil at all. At that time I done all the cutting out myself; I mean that saw did.

Int. 11. How long was it, as near as you can recollect, after you got that first sample-bottle before you procured the one or two gallons you spoke of?

Ans. It was the very next day after that I used that sample. I sent one of the men out to the works for it, Dr. Tweddle's works.

Int. 12. About how long after you got the one or two gallons was it that you got the barrel of oil that you spoke of?

Ans. I should think it might be pretty near between two and three weeks; for we didn't use that oil upon any but the saw and slicking-machine, that the other oil wouldn't run well on.

Int. 13. From whom did you get the barrel of oil spoken of in your last answer?

Ans. At Dr. Tweddle's. I could not tell. I sent to Dr. Tweddle's works and the oil came to the shop.

Int. 14. You have stated that Dr. Tweddle brought you a sample of oil which you tried on your rip-saw between the 25th of April and the 9th of May, 1867. How do you fix that date?

Ans. Well, sir; I fix that date by the time he came in there and we were working on the frames for his warehouse, and the frames was delivered on the 9th day of May, 1867, and I had tried that sample before the frames was delivered. They were yet in the shop.

414 Int. 15. On what part of the saw-machinery did you use the oil that the doctor first gave you?

Ans. On the mandrel and boxes.

Int. 16. You stated in your answer to the 7th interrogatory that you did not know the doctor had started his works till you were going up the Valley road. State where the works were situated at which you saw his name as that time.

Ans. It was on the right-hand side going up the Valley road, a little piece above, where the canal-aqueduct crossed the river; the place where Capt. Brereton used to have his oil works.

Int. 17. What is the name of those works?

Ans. All I have ever heard it go by was the Aladdin Oil Works. I don't know whether Dr. Tweddle has changed the name since.

Int. 18. In your answer to the 8th question, you spoke of seeing Dr. Tweddle's name at the Standard Oil Works.

Ans. That was a mistake, I meant the Aladdin.

Int. 19. When the doctor brought you the sample-bottle of oil did you pay any attention to the smell of it?

Ans. Well, sir, when I opened the bottle, the oil we had been using, I thought there was a good deal of benzine in it, and I smelt it to see if there was any in this; I mean in the bottle the doctor brought me. I couldn't tell by it if there was any in it. If there was it had a very light smell of anything, scarcely any smell at all; but I could smell that there was something in the bottle. It didn't appear to me to be benzine.

Int. 20. What was the color of the oil in the sample-bottle Dr. Tweddle gave you?

Ans. It is a kind of a light-yellow color.

Int. 21. Look at the bottle now shown you, and state how the oil in it compares with the sample of oil Dr. Tweddle brought you to try on your saw.

Ans. Yes, sir; I believe that to be the same oil. It appears to me to be the same. It has the same color and smell, so far as I can see. It seems to be the same as we use at the present day. It seems to be the same as some that I took out of the barrel we are using now, and put it into a bottle to see what it looked like when I was notified to come here. Since I have been hurt, I have not been much about the shop. I was hurt on the 26th day of June, and have been very little about the shop since. I had been down street. I got home about half-past five o'clock in the evening. When I got home one of my children had took very sick suddenly, and Dr. Kerns had been speaking about my doing a job of repairing at his stables. He told me he was going to send his horses to the country, that he was going out a couple of weeks for his health, and I thought his horses would be gone, and I hitched up the horses and buggy for to bring him up. It was some distance from where I lived. I was turning on the street, about forty feet from Dr. Kern's house, and the boys were throwing fire-crackers, and the horse backed on me in turning round and upset the buggy, with me in it, and I was considerably hurt and over three weeks insensible.

(Bottle shown to witness referred to in the last interrogatory produced and marked "Exhibit Douglas.")

Cross-examination by Chauncey Smith, esq., counsel for complainants.

Cross-int. 1. What did you pay a gallon for the first barrel of oil you bought of Dr. Tweddle?

Ans. I can't tell, because I never asked the price. It was settled up in the work; my partner attends to the money matters. The last two barrels of oil we got since he was burned out we got this summer, and he has not sent the bill in.

Cross-int. 2. Do you know what price you ever paid for any of the oil you purchased of the doctor

Ans. I do not, sir. My partner attended to the books then; now my clerk does. My partner attends to the money matters and I don't look at the bills.

Cross-int. 3. When was it that you went up the Valley railroad and first saw the doctor's works there after he was burned out?

Ans. I think it must have been some time in April, or the beginning of May, 1871, because we had got a barrel of oil before I was hurt, and that was on the 26th of June.

Cross-int. 4. About how long did a barrel of oil last you while the doctor's works were at Sharpsburg bridge?

Ans. That's what I couldn't say; when we got through with one we got another; I couldn't say unless I had the bills; we never let ourselves be out at any time?

416 Cross-int. 5. Will you look at a note at the bottom of page 381 of the printed record and the top of page 382, and state whether that is a certificate which your firm gave to Dr. Tweddle of the merits of his oil, which your firm was using in 1868?

Ans. Yes, sir. Excepting that as to the date, we used it before that time.

Cross-int. 6. You used it also during 1868, did you not?

Ans. Yes, sir; and used it all the time we could get it. We sent for a barrel of oil once and Dr. Tweddle was away. We got a barrel in another place at the time, what they call Duck Creek oil, and then we got it from Dr. Tweddle afterwards, I don't mind how often, till he was burned out, and we got no more of it from that time till this summer; we have got the second barrel of it now, since I found out that he had started his works.

JAMES DOUGLAS.

Deposition of C. Tiers Myers, taken, subscribed, and sworn to before Wm. T. Farnham, esq., notary and commissioner.

Int. 1. What is your name, age, residence, and occupation?

Ans. C. Tiers Myers. I am 43 years of age. I reside at Philadelphia, Pa. I am engaged in the manufacture of material for washing wool.

Int. 2. Where did you reside in the years 1866 and 1867 and in what were you then engaged?

Ans. I resided in Philadephia. I was engaged in testing a car, or cars, for the transportation of oil in bulk. I had a number of them in Pittsburgh.

Int. 3. Are you acquainted with Dr. H. W. C. Tweddle; and, if yea, when did you first make his acquaintance?

Ans. Yes, sir. I first made his acquaintance in 1865 or 1866.

Int. 4. How was Dr. Tweddle engaged at that time?

Ans. He was engaged in the oil-business.

Int. 5. Producing or manufacturing?

Ans. He was the manager of the Standard Oil Works.

Int. 6. What led to your acquaintance with him?

417 Ans. As being a suitable gentleman who would advance my interests, and afford me facilities for testing and proving the value of our method of transporting oil in bulk-cars.

Int. 7. Were you ever at Dr. Tweddle's petroleum refinery, situated near the Sharpsburg bridge, in the vicinity of Pittsburg?

Ans. Yes, sir.

Int. 8. When?

Ans. In the summer of 1867. It would be well, perhaps, for me to say that when I first became acquainted with the doctor he tested one of our cars by loading it at the Standard Oil Works, while he was manager there.

Int. 9. Do you recollect the name of Dr. Tweddle's refinery at Sharpsburg bridge?

Ans. Eclipse Refinery was the name.

Int. 10. In what condition was the warehouse at Dr. Tweddle's Eclipse refinery at the time you were there in the summer of 1867?

Ans. Incomplete.

Int. 11. In what way incomplete?

Ans. Several boards on the floor in the 2d story were not laid, owing to the incompleteness of it; it was not finished. If I recollect right, some of the outside planking was not on.

Int. 12. Have you any familiarity with lubricating oils?

Ans. To a limited extent.

Int. 13. When you were at Dr. Tweddle's works at Sharpsburg bridge, during the summer of 1867, did he show you any specimens of lubricating oils, and, if so, what?

Ans. Yes, sir; showed me some dark oil and some light oils.

Int. 14. What were these oils made from?

Ans. From petroleum.

Int. 15. What was the color and general appearance of the dark oil he then showed you?

Ans. Dark greenish cast.

Int. 16. What was the color of the light oil he showed you?

Ans. Yellow.

Int. 17. About what shade of yellow?

Ans. Lightish yellow, if I remember right; about the color of sperm oil.

418 Int. 18. In your answer to the 13th interrogatory you speak of light oils. What do you mean by light oils?

Ans. I mean as to color.

Int. 19. To what purpose did you understand at that time the dark greenish oil was adapted?

Ans. For railroad-car use.

Int. 20. To what purpose did you understand the light-yellow oil to be adapted?

Ans. As a base oil, and for lubricating spindles in cotton and woollen factories, and general lubricating purposes. It was a suitable oil for mixing or compounding. It would enter into druggists' use, as he said, and expatiated on it at the time.

Int. 21. Did you take notice of the odor of the light-colored yellow oil you have just spoken of?

Ans. Yes, sir. The doctor drew the cork from a sample phial when he showed it to me, and remarked, in general terms, that there was no particular flavor about it odorous; hence its adaptability for general purposes.

Int. 22. Did Dr. Tweddle say anything to you in relation to his manufacturing that light-colored yellow oil?

Ans. Yes, sir.

Int. 23. State whether or not you got any of that light-colored yellow oil from Dr. Tweddle.

Ans. I did, sir.

Int. 24. About what time, as near as you can recollect?

Ans. Several months after. It was in the year 1867, I am pretty certain, a few months after I was there, perhaps two or three months; perhaps a month; some time after, however.

Int. 25. Are you acquainted with lubricating oil recently manufactured by Dr. Tweddle, and called by him "Neutral Topaz Oil"?

Ans. I knew of the oil that he showed me at that time, and called it neutral or topaz oil, I think. I am not acquainted with the oil he now manufactures by that name.

Cross-examination:

Cross-int. 1. In answer to interrogatory 17, which asked if you had

any familiarity with lubricating oils, you answered "to a limited extent." What do you mean by that?

419 Ans. From seeing them, and having their qualities, kinds, spoken to me of or about by a practical oil-compounder, and from reports of the operation of certain oils used by experienced men.

Cross-int. 2. What men have spoken to you about such oils?

Ans. Oil men.

Cross int. 3. You have never been engaged in the manufacture of oil, have you?

Ans. No, sir.

Cross-int. 4. Ever been engaged in the sale or purchase of oil?

Ans. I have bought and sold oils.

Cross-int. 5. What kind of lubricating oils?

Ans. Prepared oils; I mean mixed oils.

Cross-int. 6. When and where were you engaged in buying and selling such oils?

Ans. Philadelphia. I bought oil of Dr. Tweddle and sold it for Mr. Kendrick. In 1866 I bought oil of Dr. Tweddle. In 1868, and from that time up to the present.

Cross-int. 7. To what extent did you buy of Dr. Tweddle, and for what purpose?

Ans. From ten to sixty barrels per month, to be sold to railroads.

Cross-int. 8. Do you mean to say that during the whole period from 1866 to 1869 you have bought from ten to sixty barrels per month?

Ans. Not continuously, at several times—one time a year or two continuously, and at different periods.

Cross-int. 9. Did you know of the doctor's refinery being burned in 1870?

Ans. The exact year I don't. I think it was 1870. I knew of it; yes, sir.

Cross-int. 10. From the time you commenced purchasing of him in 1868 till his refinery was burned, in how many months did you make purchases of him?

Ans. I think, sir, a year and a half or two years, almost monthly.

Cross-int. 11. About what time in 1868 did you commence purchasing of him?

Ans. I think in July or August.

Cross int. 12. What kind of oil was this you purchased for railroad uses?

420 Ans. It was what he termed the Eclipse oil for railroad cars, a railroad car oil.

Cross-int. 13. What kind of looking oil was it?

Ans. It was quite dark, a rich shade of green, a greenish cast.

Cross-int. 14. What price per gallon did you pay for it?

Ans. The first few lots I bought of him I paid him twenty cents a gallon.

Cross-int. 15. After that what?

Ans. I have paid him 25, 27½, and now 30 cents.

Cross-int. 16. How did this oil smell?

Ans. I can hardly describe that. I can't find the proper word to express my understanding of the smell; it is seemingly odorless; in comparison with petroleum oil, it is odorless. I mean it has much less odor than crude petroleum; I think it has.

Cross-int. 17. How often were you at the doctor's place from 1868 till his refinery burned?

Ans. Several times.

Maiden Lane, ninety-five bbls. ref'd oil;" Eclipse, "Standard white test 168," and another piece of paper, Semi-Weekly Tribune, New York, March 1, 1867, containing a piece of black substance. The paper which has just been copied, I found in the bottom of the box this morning under the bottom newspaper, the Herald, which I had never taken out before, and I did not know until the box was opened in this room this morning that the certificate of inspection was there.

Int. 19. State who brought this box and contents to the room where you are being examined, and when.

Ans. I brought it myself this morning.

Int. 20. State how many vials are now in the box, and what they contain, if you know.

Ans. There is three vials, one contains a heavy lubricating oil, green, marked "Lombard No. 1," another one has white kerosene, Lombard No. 2. The other one, Lombard No. 3, is empty.

Int. 21. Do you know for how long a time past the vial Lombard No. 3 has been empty, and the two missing vials been absent from the box?

Ans. It is over two years since I discovered the two were miss-
424 ing and this one, Lombard No. 3, was nearly all empty, the contents having soaked out of the box, and it has all gone since.

Int. 22. State, if you know, what were the contents of the three vials (two missing and one now empty) when they were brought to you by Dr. Tweddle at the time you have already stated.

Ans. When he brought then there was this one, dark lubricating oil, and which is Lombard No. 1, and there were three of kerosene that were of high test like this Lombard No. 2, and one of straw color.

Int. 23. What did you understand the one vial of straw-colored oil to be?

Ans. At the time, I considered it a poor oil that would have to be bleached, but the doctor then told me that that was not for illuminating, but was a lubricator—what he called a spindle oil. What surprised me was its being perfectly deodorized, and yet of that dark color.

Int. 24. State, as nearly as you can describe it, what color the oil was which the doctor called spindle-oil.

Ans. As near as my memory serves me it was a rather bright straw color.

Int. 25. About what time in September, 1867, was it that Dr. Tweddle left with you the box Exhibit Lombard, and the samples you have described?

Ans. It was the last of the month, about the last week in the month.

Int. 26. Have you any recollection of Dr. Tweddle living in a house on the top of a hill above the Standard Works near Pittsburg?

Ans. Yes; I was at his house in 1866, near the Standard Works.

Int. 27. Do you recollect of hearing of that house being burned, if so, do you know about what time?

Ans. I remember of seeing the account of the fire. I can't state the time. It was some time after I was there. I don't remember now.

Int. 28. State what further, if anything, you did in relation to getting up the company for Dr. Tweddle, for the manufacture of his oils, as you have stated?

Ans. In the fall of 1867, I applied to a number of parties, and laid his statements and plans before a number of capitalists, among which was a Mr. Stearns, of Erie, and a Mr. Crosby, of Westfield, who had agreed to take up this matter, and I was at their house in December, and I then made an arrangement with them to meet them in
425 Pittsburgh on the following week, to close up a programme that

we had prepared. I left Westfield on the 17th or 18th, for New York, and on our way to Buffalo that Angola accident occurred, and I was considerably injured, which ended the negotiations, in consequence of my not being able to attend to it.

Int. 29. State what the Angola accident was, and when it occurred?

Ans. There were two cars run off the track at Angola, on the Buffalo and Erie Railroad. The hind car was thrown off and burnt up with all its passengers; the next car was thrown off and broken to pieces and killed a good many. That was the car I was in. I was injured so that I was kept in Buffalo a month or six weeks; in fact, I haven't got over it yet. It was about a year after before I was able to attend to business; and then I went abroad partly on that account, and was gone nine months more. I think the accident occurred on the 18th day of December. It was the 18th day of December.

Int. 30. What effect did your accident and subsequent disability from business have on the negotiations which were pending for the getting up of Dr. Tweddle's company?

Ans. Well, as soon as I was hurt I received letters from them, inquiring the probabilities of my being able to go on. Without me they declined to do anything more in the premises.

Cross examination by Chauncy Smith, esq., complainant's counsel:

Cross-int. 1. Did Dr. Tweddle, in his conversations with you, show you a circular or prospectus which he had prepared, setting forth the advantages of his new process?

Ans. There was some little prospectus book. I don't remember particularly about them.

Cross-int. 2. It was a small pamphlet, was in not?

Ans. Yes; I think it was.

Cross int. 3. Do you recollect of its being in yellow covers?

Ans. I think it was.

Cross-int. 4. Did you make use of those pamphlets in your interviews with parties whom you sought to enlist in the enterprise?

Ans. I don't think I did. I might, possibly.

Cross int. 5. Do you remember anything about their contents?

Ans. No; I do not.

Cross-int. 6. Won't you look at pages 371 of the printed rec-
426 ord in this case, at the bottom of the page, under the heading, "Exhibit 77," and at what follows on pages 372, 373, 374, and 375, and see if that refreshes your recollection at all as to the contents of that prospectus or pamphlet?

Ans. That's substantially the same as the prospectus I had, which I think was in writing; I think it was written off.

Cross int. 7. The yellow covered pamphlets which you saw were in print, were they not?

Ans. Yes.

Cross int. 8. In the table on page 375 of the printed record which purports to give the products which might be obtained by Dr. Tweddle's process, I find benzole mentioned as one of the products of which 8,000 barrels might be produced from 100,000 barrels of crude petroleum. Do you recollect whether either of the bottles which came to you in the box you have produced contained benzole or naphtha?

Ans. There was nothing said about benzole or naphtha, to my recollection.

Cross-int. 9. Do you know Mr. Samuel Downer, who is now present in the room?

Ans. I have met him frequently, and known him by reputation for a long time.

Cross int. 10. Do you recollect seeing him at your office in March last?

Ans. I remember his being there early in the spring. I think it was March.

Cross-int. 11. Do you remember the subject of conversation between you and him at that time?

Ans. It was in relation to this suit. I don't remember all that was said.

Cross-int. 12. Do you remember whether you showed to Mr. Downer, at that time, the box and contents which you have produced this morning?

Ans. I remember telling him I had such a box. I don't remember showing it to him.

Cross-int. 13. Do you remember telling him what the contents were at the time he was there?

Ans. Yes.

Cross-int. 14. The contents were the same then that they are now, were they not?

427 Ans. Yes.

Cross-int. 15. And so you stated to him, did you not?

Ans. I presume I did. I stated the facts about it.

Cross-int. 16. Do you remember making any statement to him at that time about the number of bottles the box contained when it was brought to you by Dr. Tweddle?

Ans. My impression is I told him that they were four, five, or six bottles that were brought; some were gone.

Cross-int. 17. Do you remember what number you said it was?

Ans. I could not have told him positively; I didn't remember.

Cross int. 18. Are you sure that you mentioned the numbers five and six to him?

Ans. I am not. I mentioned there was a number; some were gone, were taken out in my absence, and one leaked out in the box. I told him that, but whether it was the yellow oil or white oil, I could not tell.

Cross-int. 19. Did you not tell him, in terms or in substance, that previous to the time of the accident, you had been engaged in making up a company for Dr. Tweddle?

Ans. I think I did.

Cross int. 20. And did you not also tell him, in terms or in substance, that previous to the accident you had four bottles of samples; that you had the case then with two bottles, the light and the dark, but the intermediate one bottle leaked out, and that one bottle had been taken away?

Ans. He might have so understood it, but I don't think I designated just four bottles, because I know there was five bottles originally, and there might have been six.

Cross-int. 21. What makes you think there might have been six bottles?

Ans. I don't think there was. There might have been. I have no recollection but of one dark bottle. There was three of what I termed kerosene, two different shades, and one of straw color.

Direct examination resumed:

Int. 1. Is not Mr. Downer very hard of hearing?

Ans. He is.

L. L. LOMBARD.

428 *Deposition of Joseph Clark, taken, subscribed, and sworn to before Wm. T. Farnham, esq., notary and commissioner.*

Int. 1. What is your, name, age, residence, and occupation?

Ans. Joseph Clark. I am 38 years of age. I reside in Alleghany County, Pennsylvania, about ten miles from Pittsburg. I have been engaged in the oil business, and am so still.

Int. 2. In whose employ are you now?

Ans. I am in Dr. Tweddle's employ.

Int. 3. When did you first know Dr. Tweddle?

Ans. I knowed him in the summer of 1861.

Int. 4. Where and how was he then employed?

Ans. He was then employed at Sellers & Canfield's oil refinery in Pittsburg.

Int. 5. When were you first in his employ, and where?

Ans. I was in his employ, in the fall of 1862, at the Standard Oil Works.

Int. 6. What was he doing there?

Ans. He was building the works.

Int. 7. Had they commenced building the works before you went into his employ there?

Ans. Yes, and they had part of the buildings up.

Int. 8. The Standard Works were a petroleum oil refinery, were they not?

Ans. Yes, sir.

Int. 9. What process of distillation was practised there?

Ans. Distilling by fire and superheated steam.

Int. 10. Do you know who directed the construction of the apparatus at the Standard Works?

Ans. Yes, sir; it was Dr. Tweddle.

Int. 11. Until what time did you continue with Dr. Tweddle at these works?

Ans. Until December 30th, 1866.

Int. 12. Who was manager of the Standard Works during the time you were there?

Ans. Dr. Tweddle was.

429 Int. 13. What did you do after you left the Standard works?

Ans. I still was in his employ at his new works at Sharpsburg bridge.

Int. 14. Was the construction of Dr. Tweddle's works at Sharpsburg bridge commenced before or after you left the Standard Works on December 30, 1866?

Ans. Before; some two or three weeks before.

Int. 15. In what capacity were you in Dr. Tweddle's employ at his works at Sharpsburg bridge?

Ans. I was his general foreman of the works.

Int. 16. What were these works called?

Ans. The Eclipse Works.

Int. 17. What description of apparatus was first employed for distilling oil at Dr. Tweddle's Eclipse Works?

Ans. A cast-iron vacuum-still with superheated steam.

Int. 18. By what apparatus was the vacuum created?

Ans. By a large duplex pump.

Int. 19. How was that still heated?

Ans. By superheated steam.

Int. 20. How was the superheated steam applied?

Ans. It was applied into a still through pipes.
Int. 21. Was that still adapted to be heated by fire?
Ans. No, sir.
Int. 22. Was it ever so heated?
Ans. No, sir.
Int. 23. Is that still in existence yet, and where?
Ans. Yes, sir; at the Sharpsburg Bridge Works.
Int. 24. How long did you continue at those works—the Eclipse Works at Sharpsburg bridge?
Ans. Until the 1 th of September, 1868.
Int. 25. When was that first still at the Eclipse Works first put into operation?
Ans. It was put into operation about the latter end of April or first of May, 1867.
Int. 26. When you first used it at the time you have just mentioned, state how it was used: 1st. What was the condition of the still when the oil was introduced?
430 Ans. It was first heated up by superheated steam.
Int. 27. What was the condition of the oil; that is to say, was it crude oil, or had it received previous treatment?
Ans. It was crude oil.
Int. 28. What was the condition of the still as to vacuum or otherwise?
Ans. We had a vacuum in the still.
Int. 29. What was the first product or result of distillation?
Ans. Benzole.
Int. 30. What was the second product?
Ans. Illuminating oil.
Int. 31. About what was the gravity of the illuminating oil, or second product you have mentioned?
Ans. The average gravity of it was about 45 or 46.
Int. 33. What was the next, or third product of the distillation?
Answer. The third product of distillation was a heavy yellow oil.
Int. 34. About what gravity was this third product?
Ans. It was about 32.
Int. 35. Were these products kept separate, or were they all run into the same receiver?
Ans. They were kept separate.
Int. 36. Was the distillation carried on further or not?
Ans. It was not.
Int. 37. Was there any, and, if any, what residuum left in the still after the third product was carried over?
Ans. Yes, sir; it was a dark green heavy oil.
Int. 38. What was the second product—I mean that which came after the benzole—called by Dr. Tweddle.
Ans. Refined oil.
Int. 39. What was third product called by him?
Ans. He called it the spindle or machinery oil.
Int. 40. What was the residuum left in the still called by him?
Ans. It was called the Eclipse railroad oil.
Int. 41. During the time that you remained at the Eclipse Works at Sharpsburg bridge, did or did not this first apparatus continue to be used by Dr. Tweddle?
Ans. It did continue to be used.
431 Int. 42. In what way; the same, or a different way?
Ans. It continued to be used in the same way.

Int. 43. What was the character, appearance, and odor of the residuum remaining in the still after the process of distillation which you have described? I refer to the first use of the apparatus you have mentioned at the Eclipse Works.

Ans. It was a heavy lubricating oil, of a dark green color, and from 28 to 30 gravity. It did not have very much odor.

Int. 44. What was the character, appearance, and odor of the third product which you say was called spindle or machinery oil?

Ans. It was a yellow oil of about 30 to 32 gravity. It did not have much odor.

Int. 45. You have stated that after the first use of this apparatus at the Eclipse Works, it continued to be used while you remained there, in the same way. State whether or not the same products which you have named as distillates, and the residuum were produced in such subsequent use of the apparatus.

Ans. Yes, sir; they were.

Int. 46. Where were you living at the time when you left the employ of Dr. Tweddle, at the Eclipse Works?

Ans. I was living in a house furnished to me by Dr. Tweddle, close to the works.

Int. 47. Are you acquainted with the oil now made and sold by Dr. Tweddle under the name of "Neutral Topaz Oil?"

Ans. Yes, sir.

Int. 48. State how that "Neutral Topaz Oil," now made by Dr. Tweddle, before the paraffine is expressed out of it, compares with the spindle or machinery oil, or third product of distillation, made by the apparatus, at the Eclipse Works, in April or May, 1867?

Ans. It is about the same oil; there is no difference in it.

Int. 49. How does it compare in color and odor?

Ans. Color and odor are about the same.

Int. 50. Did this first production of machinery or spindle oil made in April or May, 1867, have the paraffine pressed out of it at that time?

Ans. It had not.

Int. 51. Did you, at any time previous to your leaving the Eclipse Works, press out the paraffine from this spindle-oil, or third distillant, and if so, when, where, and how?

432 Ans. I pressed some out in September, 1867, in the machine-shop attached to the works, in an iron drill-press, where I got power to press it with.

Int. 52. Did you ever use any of this spindle or machinery oil on any machinery, and if so, when and where?

Ans. Yes, sir; I used some of it on our machinery at the works directly after pressing it at the time I spoke of, in September, 1867.

Int. 53. Are you acquainted with the firm of Douglass & McKee, of Pittsburg?

Ans. Yes, sir.

Int. 54. Do you know whether or not they used any of this spindle or machinery oil at any time, and if so, when?

Ans. They did use some of it; they got some in the month of May, 1867.

Int. 55. Did you or not make any inquiries of them in regard to its operation as a lubricator, and if so, when?

Ans. I made inquiry about in the month of May, 1867, when I was down at McKee & Douglas's shop.

Int. 56. What were you down at their shop about?

Ans. I went down to their shop to hurry them up in some work they

were doing for us. They were making a lot of window-frames for a new warehouse the doctor was building at his works.

Int. 57. What did you learn by inquiring of McKee & Douglas as to the operation of that oil as a lubricator?

Ans. I learned from them that they had used it on part of their machinery at the shop, and that it worked very well.

Int. 58. Did this spindle oil which McKee & Douglas had in 1867 have the paraffine expressed out of it or not, if you know?

Ans. It did not.

Int. 59. Do you know what difference, if any, it makes in the use of this machinery oil as a lubricator, whether the paraffine has been pressed out or not?

Ans. I think it don't make any difference.

Int. 60. You spoke of having pressed out the paraffine from some of this spindle or machinery oil in the drill-press in September, 1867. State by whose instructions you did this.

Ans. Dr. Tweddle's instructions.

433 Int. 61. Between the time when you commenced making this third distillant or spindle oil, in May, 1867, and September, 1867, had you accumulated any of this oil at the works; and, if so, about what quantity?

Ans. We accumulated upwards of one hundred barrels of it.

Int. 62. While you were with Dr. Tweddle at the Standard Oil Works, do you recollect of his having there some strong-smelling crude petroleum; and, if so, do you know or did you learn where it came from?

Ans. Yes, sir; he had some strong-smelling crude petroleum oil there, and I learned that it came from Kentucky.

Int. 63. About what quantity, as near as you can recollect?

Ans. There was about 240 barrels.

Int. 64. Did Dr. Tweddle do anything with this oil, and, if so, what?

Ans. Yes. He treated the crude oil with sulphuric acid in an agitator.

Int. 65. What did he then do with it?

Ans. He then distilled it.

Int. 66. State whether or not he used fire in the distillation.

Ans. Yes, sir; he did; fire and superheated steam both.

Int. 67. What was the character of the distillate?

Ans. It still had an offensive odor.

Int. 68. In this first distillation, was the whole distillant, the heavy and light oil, run together?

Ans. Yes, sir.

Int. 69. What was the character of the residuum of that first distillation?

Ans. It was a heavy tar, of a very darkened color.

Int. 70. Was there any coke left in the still?

Ans. Yes, sir.

Int. 71. State whether or not you redistilled this first distillate.

Ans. We did.

Int. 72. In what kind of a still, and what kind of heat?

Ans. In what we called a 300-barrel still, by fire and superheated steam.

Int. 73. State whether or not there was any apparatus on that still by which you could ascertain its contents, while the operation was proceeding.

Ans. Yes, sir; there was. There was gauge-cocks at different
434 points on the still, both before and after the working with that

stinking oil. The gauges were always on, were on when the still was built.

Int. 74. What was the character of the product or distillate of this second distillation?

Ans. It was almost a white oil; that is, the illuminating oil; we made two kinds of oil on the second distillation out of that still; one was illuminating-oil, and the other was a heavy lubricating oil.

Int. 75. Was this heavy lubricating oil a distillate or a residuum?

Ans. There was a small portion of the distillant a heavy lubricating oil.

Int. 76. What was the character of the oil remaining in the still?

Ans. It was a heavy dark-yellow oil.

Int. 77. State whether or not this heavy oil remaining in the still had much odor.

Ans. It did not.

Int. 78. Do you know what use any of this residuum oil remaining in the still was put to?

Ans. Yes, sir; we used it at the Standard Oil Works for lubricating our machinery.

Int. 79. State whether or not you barreled any of that heavy residuum oil.

Ans. Yes, sir.

Int. 80. By whose direction was this done?

Ans. Dr. Tweddle's.

Int. 81. At the Standard and the Eclipse Works, while you were there, was it or not the practice to have gauges upon the stills?

Ans. It was the practice to have it on all stills.

Int. 82. What were these gauges for?

Ans. They were for testing the quality and quantity of the oil during distillation.

Int. 83. Did you have charge of the distilling-house of the Standard Works? If not, who had?

Ans. I had. I also had it at the Eclipse Works during the time I was there.

Int. 84. You have stated in your answer to the 79th interrogatory that the gauges on the stills at the Standard and Eclipse Oil Refineries were for testing the quality and quantity of the oil during distil-
435 lation. State whether or not the gauges were so used while you had charge of the still-houses at these works; and, if so, with what frequency they were used.

Ans. They was used in that time every few hours, sometimes oftener.

Int. 85. State whether or not you were able by these gauges to draw off any portion of the contents of the still during the process of distillation?

Ans. I was.

Int. 86. State whether or not this was actually done in practice.

Ans. Yes, sir; it was done every time.

Int. 87. In your answer to the 59th direct interrogatory and subsequent interrogatories, you speak of the distillation of some strong-smelling crude petroleum which you learned had come from Kentucky. State when it was that this distillation was made.

Ans. It was made there in the early spring of 1865, or the winter of 1864 and 1865; at any rate, it was cold weather.

Int. 88. State as near as you can the gravity of the residuum oil of the second distillation of that oil.

Ans. I don't remember the gravity of it now; but I know it to be a

rich, heavy oil, heavier than that which Dr. Tweddle now makes of a dark amber color.

Int. 89. State how the oil from which the paraffine was expressed in September, 1867, as stated in your answer to the 48th interrogatory, compared as to color, odor, and gravity with the "neutral topaz oil" now made by Dr. Tweddle.

Ans. That was precisely the same kind of oil.

Int. 90. State whether or not you had any experience in the distillation of petroleum oils prior to your employment with Dr. Tweddle at the Standard Works.

Ans. Yes, sir; I had a large experience.

Int. 91. Where?

Ans. With the firm of Reese & Graff, Pittsburg.

Int. 92. By what process was the oil distilled at these works? I refer especially to the mode of heating the still.

Ans. By fire and superheated steam.

436 Int. 93. In the distillation of petroleums by fire and superheated steam, what is the residuum left in the still after distillation?

Ans. It is a heavy black tar and coke.

Int. 94. Have you any experience in the distillation of petroleums by fire without superheated steam?

Ans. I have.

Int. 95. What is the residuum?

Ans. The residuum is principally coke in the bottom of the still.

Int. 96. State, from your experience as a practical distiller of petroleum, whether you know of any mode by which crude petroleum can be distilled by the use of fire, or fire and superheated steam, without a vacuum, by which the deposit of coke as the residuum of the still can be prevented.

Ans. I don't know of any.

Int. 97. In the distillation of crude petroleum with superheated steam and vacuum, as practised by you at Dr. Tweddle's Eclipse Works, state whether or not there was any deposit of coke as residuum in the still?

Ans. There was not.

Int. 98. How frequently, if at all, did the stills at the Eclipse Works, heated with superheated steam under vacuum, have to be cleaned out?

Ans. They never was cleaned out; didn't need it.

Int. 99. How frequently, if at all, is it necessary to clean out the stills after the distillation of crude petroleum by fire without a vacuum?

Ans It is necessary to clean them out every time they are used.

Int. 100. How is it when they are heated by fire and superheated steam without vacuum?

Ans. They also have to be cleaned out.

Int. 101. In the distillation of crude petroleum by fire, in your experience as a practical distiller, what is the effect on the residuum as to odor or smell previous to the point at which it deposits free carbon or coke?

Ans. It has a very offensive smell at that point. I mean at the time coke commences to form in the still.

Int. 102. How is it previous to the point at which it deposits coke, while the illuminating oil is being distilled over? I mean by fire-distillation.

437 Ans. It still has an offensive smell.

Int. 103. In distilling crude petroleum by fire and superheated steam, when you have taken off the benzole and part of the illuminating-oil, what is the condition of the contents of the still as to smell?

Ans. The oil in the still don't smell so bad as it did when the benzole and part of the illuminating oil was in it.

Int. 104. How long have you known this fact?

Ans. I have known that fact since the summer of 1861.

Int. 105. In distilling crude petroleum by superheated steam with vacuum, without the use of direct fire, in the manner practised by you at Dr. Tweddle's Eclipse Works from April or May, 1867, until the time you left there in September, 1868, state whether or not if the distillate which comes over, after it reaches 37 or 38 degrees Beaumé, be collected in a separate receiver, will be the same oil as the spindle oil which you spoke of making in April or May, 1867, and as the oil made by Dr. Tweddle under the name of "Neutral Topaz Oil?"

Ans. Yes, sir; that oil would just be the same.

Int. 106. Down to what degree Beaumé were you in the habit of carrying the distillation of this spindle oil?

Ans. From 30 to 27.

Cross-examination by complainant's counsel:

Cross-int. 1. When you left the employment of Dr. Tweddle in 1868, into whose employment did you go?

Ans. I went into the employ of Brereton & Wilkins.

Cross-int. 2. At what place?

Ans. At the Aladdin Oil Works, about thirty miles above Pittsburg, on the Alleghany Valley Railroad.

Cross-int. 3. How long did you remain in their employment?

Ans. I remained in their employment till July 1st, 1869.

Cross-int. 4. Where did you go then?

Ans. I moved to Pittsburg, and didn't go to work for any person just then.

Cross-int. 5. When did you next go to work for any person, and who was it?

438 Ans. During that fall, or rather beginning of winter, I went to work for Andrew Fulton's son, or sons, Pittsburg.

Cross-int. 6. At what were you employed while with them?

Ans. At fitting out steamboats on the river.

Cross-int. 7. How long did you remain in their employment?

Ans. I remained until December of that same year, about the 1st of January next.

Cross-int. 8. Into whose employment did you next go, and when?

Ans. I then went into the employment of Lockhart, Frew & Co., in the fall of 1870.

Cross-int. 9. What did you do for them?

Ans. I was engaged in the machine-shops belonging to their works, doing all their machine-work and keeping up the machinery.

Cross-int. 10. What works?

Ans. Petroleum oil works.

Cross-int. 11. Where were these works situated, and by what name were they called?

Ans. They were situated on the Alleghany Valley Railroad, about six miles from Pittsburg, now within the city limits, and were called the "Brilliant Oil Works."

Cross-int. 12. How long did you remain in the employment of Lockhart, Frew & Co.?

Ans. I remained in their emply till June of the present year.

Cross-int. 13. Did you have the same employment during the whole time you were employed by them?

Ans. Yes, sir.

Cross-int. 14. When you left their employment into whose employment did you next go?

Ans. I went into the employment of Dr. Tweddle.

Cross-int. 15. At what time did you enter his employment?

Ans. On the 4th of July of the present year.

Cross-int. 16. What effect did the sulphuric acid have upon the Kentucky oil you have spoken of when it was first treated with it in the agitator?

Ans. It left a sediment of thick tar, like pitch, in the bottom of the agitator, that settled out of the oil.

Cross-int. 17. How did it leave the oil after the sediment had been removed?

439 Ans. The sulphuric acid took all the heavy sediment and tar out of the oil and left it in a pure state.

Cross-int. 18. What do you mean by a pure state?

Ans. I mean by a pure state that most of the impure sediment, or heavy oil that was in it was taken out by the sulphuric acid.

Cross-int. 19. What was its color and odor after it had been treated with acid and before it was distilled?

Ans. It was a dark-green color; very offensive odor.

Cross-int. 20. When you distilled it what did you first obtain?

Ans. Benzole.

Cross-int. 21. What percentage of benzole did you get?

Ans. I do not remember the percentage, but I do remember that there was very little benzole in it.

Cross-int. 22. What did you obtain next after the benzole?

Ans. Illuminating oil.

Cross-int. 23. How much—what percentage of the crude oil?

Ans. I do not remember the percentage.

Cross-int. 24. State as near as you can, according to your best recollection or judgment.

Ans. I don't remember measuring it to get the percentage of it.

Cross-int. 25. Can't you give us some idea about how much illuminating oil was obtained—whether 25 or 50 per cent., or any other proportion of the crude oil?

Ans. I judge we got more than that—more than 50 per cent.

Cross-int. 26. Can you form any judgment as to how much more?

Ans. I should say about 15 or 20 per cent. more.

Cross-int. 27. That is from 65 to 70 per cent?

Ans. It would make it about that.

Cross-int. 28. What was the character of this illuminating oil as to color, density, and odor?

Ans. The character of it was light straw color, and the odor of it was offensive, bad odor. I am not positive as to density; I should think about 46.

Cross-int. 29. What else did you obtain at the first distillation besides the benzole and illuminating oil?

Ans. There was a heavy oil distilled off it after we got the illuminating off—a heavy yellow oil.

440 Cross-int. 30. How much was there of that?

Ans. A small quantity; I can't say precisely how much.

Cross-int. 31. What was its character as to density and smell?

Ans. It had a bad odor; its density was about 38.

Cross-int. 32. You also had a residuum left in the still?

Ans. Yes, sir.

Cross-int. 33. What was the character of that?

Ans. It was tar and coke.

Cross-int. 34. About what percentage of the crude oil?

A. I don't know that.

Cross-int. 35. Did you do anything with the illuminating oil, as you call it, before you redistilled it?

Ans. It was treated in the agitator with sulphuric acid.

Cross-int. 36. What effect did this treatment have upon it?

Ans. It still improved the oil.

Cross-int. 37. In what way did it improve it?

Ans. It took the paraffine out of it.

Cross-int. 38. Did it do anything else to it?

Ans. Yes.

Cross-int. 39. What did it do?

Ans. It took most of all the impurities out of it that was in it.

Cross-int. 40. What kind of impurities?

Ans. Paraffine, or sediment, or dirt, or anything that might be in it.

Cross-int. 41. Did you collect any paraffine that you took out of it?

Ans. No, sir; we ran it away.

Cross-int. 42. Ran it away how?

Ans. By opening a cock in the bottom of the agitator.

Cross-int. 43. How do you know there was paraffine in what ran away?

Ans. I knew there was paraffine ran away because it was freer from paraffine than when it went in the agitator.

Cross-int. 44 How did you know that?

Ans. By the looks of the oil.

Cross-int. 45. What was there in the looks of the oil which showed you there was paraffine in it?

Ans. At the time that oil was treated in the agitator, or before it was treated, I could see the paraffine in it, it being cold weather; after it was treated I could not.

441 Cross int. 46. What was the color of what was drawn off from the agitator?

Ans. It was almost black, with a blue tint, owing to its being mixed with sulphuric acid.

Cross-int. 47. What was the color and odor of the oil after it was treated with sulphuric acid?

Ans. It was a light straw color. The odor was rather better than before it was treated.

Cross-int. 48. When you redistilled it what did you first obtain as a distillate?

Ans. A small quantity of benzole.

Cross-int. 49. About what percentage of the oil redistilled?

Ans. I don't know positively, as I did not measure it. I think one to two per cent; a very small quantity of it.

Cross-int. 50. You said in your direct examination that you obtained an illuminating oil, white, or nearly white; what percentage of this oil did you obtain?

Ans. I did not measure it to get the percentage.

Cross-int. 51. According to your best judgment, about what did you obtain?

Ans. According to my judgment we would get more than on the former distillation.

Cross-int. 52. You next obtained a lubricating oil as a distillate; what percentage did you get of this?

Ans. A small percentage, I don't remember what. I did not measure the oils to get the percentage on either experiment.

Cross-int. 53. Do you recollect about what gravity the oil was running when you stopped collecting the illuminating oil and began to collect the lubricating oil which was distilled over?

Ans. I do not.

Cross-int. 54. What was the color and odor of the heavy lubricating oil which was distilled over?

Ans. It was a yellow oil; had an odor to it not very offensive.

Cross-int. 55. Was it a light or dark yellow?

Ans. It was more of a light yellow color.

Cross-int. 56. What you would call a straw color?

Ans. It was darker than what I would call a straw color.

442 Cross-int. 57. You stated that you barrelled some of the residuum in the still after the second distillation; how much was barrelled, and what was done with it?

Ans. There was about two barrels, one I am certain, and I think two. I barrelled one barrel, and by Dr. Tweddle's orders it was taken into the machine-shop and used on the machinery all around the works.

Cross-int. 58. How much was there of this residue oil?

Ans. I can't positively say. I judge from eight to ten barrels.

Cross-int. 59. What was done with the balance besides the one barrel you have spoken of?

Ans. There was more than one barrel of it; the balance was left in the still, and crude oil pumped on top of it.

Cross-int. 60. You said that still was a 300 barrel still. What was the shape of it?

Ans. It was a cylinder—boiler shape.

Cross-int. 61. What wae its length and diameter?

Ans. I am not positive. I should say about 20 feet long and ten in diameter. It stood horizontally.

Cross-int. 62. What was done with the heavy lubricating oil which was distilled over?

Ans. It was run into what we call a black-oil tank, for receiving dark oils.

Cross-int. 63. Do you recollect about how much there was of it?

Ans. I do not recollect exactly; I judge from two to three barrels.

Cross-int. 64. In the black-oil tank this oil was mixed with other oil, was it not?

Ans. Yes.

Cross-int. 65. Do you recollect about what the gravity of this oil was?

Ans. It was about 37 or 38; I don't remember exactly now.

Cross-int. 66. About what was the gravity of the residuum oil?

Ans. I don't remember of testing to ascertain its gravity; it was a very heavy oil.

Cross-int. 67. What was done with the illuminating oil which you procured at the second distillation?

Ans. It was then pumped into the agitator and treated there in the usual way, and pumped from there into the bleaching tanks.

443 Cross-int. 68. What was it treated in the agitator for?

Ans. To still further purify and deodorize it.

Cross-int. 69. How much did you use the first still erected by Dr. Tweddle, at the Eclipse Works, at Sharpsburg bridge, between September, 1867, and the time you left, in September, 1868.

Ans. We did not use that first still very often from September, 1867, until I left.

Cross-int. 70. Did you use it any during the fall of 1867, after September, and during the winter and spring following?

Ans. We did not use it during the fall of 1867, and during that winter, if at all, only two or three times.

Cross-int. 71. During that winter and spring Dr. Tweddle erected two other stills, did he not?

Ans. He did.

Cross-int. 72. When were those stills first put into operation?

Ans. In the spring of 1868, early in the spring.

Cross-int. 73. What kind of stills did they have at the Aladdin Works when you went there in the fall of 1868?

Ans. The stills there was identically the same as those he constructed in the winter of 1867 at his own works.

Cross-int. 74. What kind of oil did they produce at the Aladdin Works while you were there?

(Counsel for respondent objects to this question, as well as the preceding one, on the ground that it is not cross-examination, and refers to matters not alluded to in the examination-in-chief.)

Ans. We produced illuminating oil—a heavy paraffine oil; and that that Dr. Tweddle calls heavy lubricating oil.

Cross-int. 75. Was this heavy paraffine oil that you produced there the same kind of oil that you have spoken of as the third product produced in the doctor's still in the summer of 1867?

(Objected to for the reasons given to the 74th question, and for the further reason that the Aladdin Works were not at that time owned, controlled, or managed by Dr. Tweddle.)

Ans. It was precisely the same oil.

Cross-int. 76. Did you produce that same kind of oil during the whole time you were there?

Ans. No, sir; I did not.

444 Cross-int. 77. During how large a portion of the time that you were there did you produce this kind of oil?

Ans. We continued to produce it in small quantities for several weeks; we did not run regularly at that works.

Cross-int. 78. Did you produce it at all times when you were running the stills?

Ans. Yes, sir.

Cross-int. 79. Can you state about what quantity you produced?

Ans. We produced several barrels of it every time we run the still, that is, every day.

Cross-int. 80. What was done with it?

Ans. There was a portion of it kept at the works, and a portion redistilled over again, because we had no tanks to put it in at the works, except to put it in a large tank which could hold thirty or forty thousand barrels, and that they did not want to put it in, as so small a quantity would make no show in so large a tank.

Cross-int. 81. About what percentage of the heavy paraffine oil did you obtain from the crude oil at the Aladdin Works?

Ans. I cannot tell, as I did not measure it.

Cross-int. 82. How much was there of it on hand when you left those works?

Ans. There was a number of barrels, I do not know how many.

Cross-int. 84. When you redistilled it did you do it separately, or mixed with crude petroleum?

Ans. We mixed it with crude petroleum.

Cross-int. 85. When running those stills did you have a fire under the stills?

Ans. No, sir; I did not. I put one there shortly before I left the

works; not a fire, but the means of using flame under the stills—that is, not a regular furnace—which was suggested to me by Captain Brereton, one of the proprietors of the works.

Cross-int. 86. What means did you put there for using flame?

Ans. I put in a small pipe for the purpose of burning benzole under the still.

Cross-int. 87. You were the superintendent of the Aladdin Works while you were there, were you not?

Ans. I acted as such in Capt. Brereton's absence.

445 (The preceding questions which refer to the Aladdin Works objected to by respondents' counsel, complainant's counsel consenting that the objection is in time.)

Cross-int. 88. Who took your place as superintendent at Dr. Tweddle's refinery when you left in 1868?

Ans. I can't answer from my own knowledge, as I have only been to his place two or three times from the time I left till the present. I can only say what I heard.

Cross-int. 89. When running the first still erected by the doctor at the Eclipse Works, during the summer of 1867, about what percentage of naphtha or benzole did you obtain from the crude oil?

Ans. I did not measure it; therefore I can't say what the percentage was.

Cross-int. 90. Give your best judgment.

Ans. The oil that we used varied so that it would be difficult for me to tell.

Cross-int. 91. Can you give me any idea of what proportion of illuminating oil you obtained from the crude oil on an average?

Ans. I can't tell. I can merely guess to the best of my judgment.

Cross-int. 92. Well, give us the best of your judgment.

Ans. I would think he made about 60 per cent.—55 to 60.

Cross-int. 93. Now, will you give us the best of your judgment as to what he obtained on an average of the first product, naphtha or benzole?

Ans. That I did not measure, therefore I can't tell; it varies so, sometimes more and sometimes less.

Cross-int. 94. Can't you give me some judgment as to what it was on an average?

Ans. I should not think it was more than eight per cent.

Cross-int. 95. About what proportion did you get on an average of the third product, the lubricating oil which was distilled over after the illuminating oil?

Ans. There would be about, probably, 10 per cent. of it, of the oil we was using; it might be more or less.

Cross-int. 96. About what proportion of the heavy green lubricating oil left in the still as a residuum?

Ans. There would be about from 20 to 25 per cent. of it. The oil is different at different times. I mean the oil we use.

446 Cross-int. 97. Will you describe the manner in which you used the still when making these four products?

Ans. I first started my pumps, and got up a vacuum in the still; then I turned on superheated steam into the pipes in the still to heat it up. Then I would open a cock from one crude oil tank, between the crude oil tank and the still, and let the crude oil drip over the pipe in the still, and converted a portion of the oil into vapor, and from there our distillation commenced; we continued our distillation; we first got over a small portion of benzole; second, our illuminating oil, and then our heavy machinery, a spindle oil we called it at that time; the balance of

the oil left in the still, the residuum, was dark green, heavy lubricating oil—what he called then, and now, Eclipse lubricating oil.

Cross-int. 98. How long did you allow the crude oil to flow into the still after you first opened the cock between the still and crude oil tank?

Ans. We distilled oil in the spring of 1867 in more ways than one, so that you will have to confine me to one or two ways before I can answer the question. I mean, we put the oil into the still in more ways than one, I should have said.

Cross-int. 99. Taking the way you have just described, how long did you allow crude oil to flow into the still after you had opened the cock?

Ans. Several hours, according to the time we wanted to continue this distillation. I could continue it for several days or a few hours.

Cross-int. 100. About how much oil would flow in in an hour when you were carrying on the distillation as you have described it?

Ans. There would be several barrels, 12 or 15 barrels, according as we wanted to put it in; sometimes we would want to put it in fast.

Cross-int. 101. What were the other ways you referred to in which you used the still?

Ans. By heating up the still in the manner I have already described and putting in a quantity of crude petroleum together, putting it in fast, what we would call a regular charge of the still, and distilling it down the same as we did on the other way, and got about the same results.

Cross-int. 102. When using the still in this way, about how much crude oil did you put in for a charge?

Ans. I should think we put in 50 barrels or upwards.

447 Cross-int. 103. When using it the other way how long did you generally run the still from the time you let in crude oil until you stopped?

Ans. That would depend on the quantity of oil we wanted to distil. If we had a large quantity we could continue distillations for a week at a time, or longer, or stop in a few hours, at our pleasure.

Cross-int. 104. Did you ever continue it for a week at a time?

Ans. I do not remember of continuing the still for a week at a time without stopping.

Cross-int. 105. How long do you remember continuing the still without stopping?

Ans. I remember of continuing the still from 24 to 36 hours. We have done that frequently.

Cross-int. 106. In which of these two ways did you use the still most?

Ans. The first still just occasionally during the time I was employed by Dr. Tweddle at the works; have used it a great many times, but not right straight along. I have never used it without stopping. We used it most during the time I was there, from time to time, from twelve to twenty-four hours.

Cross-int. 107. You spoke of two ways in which you used the still: one way in which you put in a charge rapidly and distilled it off, and another way in which you let the oil run in constantly for hours, perhaps a day or more. What I want to know is which way you used the still most?

Ans. We used the still mostly by letting the oil in slowly and dripping it over the pipes.

Cross-int. 108. Did you use the two stills which the doctor put up in the winter and spring of 1868 in both these two ways?

Ans. I don't remember of using them both in these two ways.

Cross-int. 109. Did you, when using these two stills, allow the oil to

flow in gradually and drip over the pipes, carrying on the operation for hours or days?

Ans. Yes, sir; I did.

Cross-int. 110. Did you ever apply heat under these stills in addition to using the superheated steam?

Ans. Yes; on several occasions.

448 Cross-int. 111. In what way did you apply the heat?

Ans. By just putting a small pipe under the still and burning a little benzole. We were not in the habit of doing it.

Cross-int. 112. Do you remember a stranger coming to see you last March, near the Brilliant Works, and asking you to go down to Pittsburg with him?

Ans. I do.

Cross int. 113. Do you know the name of that man?

Ans. Abbott, I think, is his name. I am not positive; it is a good while ago. I am pretty confident, though, that is his name.

Cross-int. 114. What did he tell you he wanted to see you about?

Ans. He asked me to go to Pittsburg with him to examine some drawings and specifications he had of Dr. Tweddle's works at Sharpsburg bridge.

Cross-int. 115. And did you go with him?

Ans. I did.

Cross-int. 116. To what place did you go with him?

Ans. I went with him to the Union Depot Hotel, Pittsburg?

Cross int. 117. Did you go to a room with him in the hotel?

Ans. I went first to the office of the hotel with him. There he registered his name and engaged a room. I went to a room with him there.

Cross-int. 118. After you had been in the room awhile did any one send up for you?

Ans. After I was in the room a short time a gentleman sent up a card for me.

Cross-int. 119. Who was that gentleman?

Ans. John Gracie, superintendent of the Brilliant Oil Works of Lockhart & Frew; the man by whom I was employed at that time.

Cross-int. 120. Did you go down to see him?

Ans. I did.

Cross-int. 121. When you left Mr. Abbott in the room did you tell him you would return to him soon?

Ans. I left him in the room, and told him I would have to go down stairs to see that gentleman, and that I might possibly be back soon.

Cross-int. 122. Did you go back soon?

Ans. I did not.

449 Cross-int. 123. Why not?

Ans. Mr. Gracie told me when I went down stairs that I should not have left the works without his knowledge, and that I ought not to be talking to men whom I knew nothing of.

Cross-int. 124. Did you tell him what you had been talking to him about?

(Objected to.)

Ans. I told him what I came there to talk about.

Cross-int. 125. Was there any one with Mr. Gracie when you went down stairs and met him?

Ans. Not that I am aware of.

Cross-int. 126. Did you see Mr. Abbott again after that; when and where?

Ans. I did, on that same day, in the afternoon. I was going over to Alleghany City, and I seen that same gentleman standing on Sixth street, formerly called St. Clair street. I walked on, and he came after me and caught up on the bridge.

Cross-int. 127. What did he say to you, and what did you say to him?

Ans. He asked me why I did not go back to the room at the Union Depot Hotel. I told him that Mr. Gracie, the man who called me down out of the room, wanted me to attend to my business at the works.

Cross-int. 128. What else did you say to him?

Ans. He asked me about giving him more testimony in regard to this still at Dr. Tweddle's works. I refused doing so, because I did not know what was the points in the case, and did not understand what he was after. He asked me was I afraid to give any more testimony in that matter. I told him I was not. I told him what I then told him in the room; I wasn't afraid to repeat it over again. Then he walked over into Alleghany City with me. I was a going to see my father at the time, and he wanted to come into the house and have a private talk, and I refused. Then he offered me the second time thirty dollars a week if I would go and work at the Downer Oil Works, Corry, I think it was, where Mr. Merrill, and, I think he told me at that time, some of Merrill's brothers was engaged about the works, and insisted on me going with him that night, pulling out his pocket-book and saying he would pay all expenses and thirty dollars a week, and engage me by the year to work at Downer's Works. Then he offered me pay for my day's wages for that day, which I didn't receive, didn't take it, and he said he was determined to have me go if it took a week. That's about the substance of our talk right on the street.

Cross-int. 129. Did you see Mr. Abbott again after that?

Ans. Yes, sir; I did.

The further taking of depositions herein was here adjourned till Monday, Nov. 27, at 10 a. m.

Nov. 27, 1871.

Taking of testimony resumed.

Cross-int. 130. When and where did you see him?

Ans. I seen him on the street at Pittsburg, in June of the present year, about the latter end of June, I think; also in the Monongahela House, Pittsburg.

Cross-int. 131. Did you see him the second time soon after you were with him at the Union Depot Hotel, in March?

Ans. It was during the same day, afternoon of the same day.

Cross-int. 132. You have stated that you saw him once in the street on the same day, and have stated what passed between you. What I wish to know is whether you saw him again, or immediately thereafter.

Ans. I don't remember of seeing after we had the conversation on the street, in Alleghany City, on the same day.

Cross-int. 133. In your answer to the 129th cross-interrogatory, you say, among other things, that in the interview with Mr. Abbott on the street in Pittsburg and Alleghany, "He asked me was I afraid to give any more testimony in that matter? I told him I was not. I told him what I then told him in the room. I wasn't afraid to repeat it over again." And what did you tell him in the room?

Ans. I gave him a description of the first still Dr. Tweddle erected at the Eclipse Oil Works as to steam pipes in the still, in answer to his

questions, and also I told him where I lived, as in answer to his question.

Cross-int. 134. Is that all you told him in the room?

Ans. There was more took place in the room, as answers to questions he put to me during the time I was in the room.

451 Cross-int. 135. State as nearly as you can what questions he put to you and what answers you made to them.

Ans. He showed me some samples of oil after he came into the room—oil that he said was Tweddle's oil and Downer oil; asked me to look at them. I did so, and laid them down again. I told him that the two different oils that he represented looked to be near the same kind of oil; that it was hard for me to distinguish any difference in them. Afterwards we sat down; he took out his memorandum or note book out of his pocket, and he asked me to give him a description of the still at the Eclipse Oil Works—the first still. I told him I thought I had no right to do that; that he brought me to a room for the purpose of examining some drawings and specifications of the Eclipse Oil Works that he said he had. We stopped right there, and I told him afterwards that I had no right to give him such information as he asked. He told me that if anything should result from me giving such information, in regard to losing my situation, or getting any ill-will from parties, that they had already talked that over, and would provide me with a good situation at five dollars a day and expenses all paid. Corry, I think, was the place he wanted me to go to. He wanted me to move my family there. I told him I couldn't move my family there, as I had just moved them out of the city into the country, and didn't want to move them again, as I was already settled. Then he commenced to ask me questions in regard to the steam pipes in Dr. Tweddle's still. I answered some of the questions he put to me as to the length, diameter, and number of pipes in that still; also answered some questions he asked me about some steam boxes in the still, as to the size of them, which I answered him. That ended the conversation about the still at that time, when he took a rest, asked me if I was going to have something to drink, and began to pull the bell. I told him I wouldn't have anything just about that time. Directly after there was a knock at the door outside. Mr. Gracie sent his card up to me in the room. The gentleman with me (Mr. Abbott, I think, was his name) took the card, looked at it, and asked me if I knew what name that was that was on it. I told him I did. He asked me who he was. I told him he was the superintendent of the Brilliant Oil Works of Lockhart, Frew & Co., where I was employed. He told the bearer of the card, who still stood at the door, that I was engaged
452 and would be down stairs in a short time. I told him that I would have to go now, as that was the superintendent of the works where I was working at, and that I would have to go to see him. I also told him that I might be up again after I had seen Mr. Gracie. On that we parted at that time.

Cross-int. 136. When you say in your last answer, "We stopped right there, and I told him afterwards that I had no right to give him such information as he asked," what do you mean by "afterwards?" Do you mean at the subsequent interview that day, or at the same interview in the room?

Ans. At the same interview in the room.

Cross-int. 137. Have you stated all that you recollect of what passed between you at the interview in the room?

Ans. All that I recollect. There may be some words that I don't remember now, as it is very difficult to remember every word.

Cross-int. 138. Did you understand the sample of Tweddle oil that Mr. Abbott showed you to be a sample of the "neutral topaz oil?"

Ans. I did. I understood so from Mr. Abbott.

Cross-int. 139. Have you stated all that you recollect saying to Mr. Abbott about the samples of oil he showed you?

Ans. I think not.

Cross-int. 140. Please to state it now, then.

Ans. I believe I remember of stating to him at the time he showed me the samples, that one of the samples I thought was made by a fire process. That is all I recollect saying about that oil at that time.

Cross-int. 141. Which one was it that you thought was made by the fire process?

Ans. I do not know, neither do I think I said at that time. I merely picked them up, looked at them, smelled them as to odor, and laid them down again. He did not hand them to me himself, he just pointed to them laying on the bed.

Cross-int. 142. Didn't you say that Dr. Tweedle never made any oil like that which Mr. Abbott showed you as Tweddle oil until about 18 months before that time?

Ans. I don't remember of saying anything of that kind.

Cross-int. 143. Didn't you say anything substantially like that?

Ans. I think not.

453 Cross-int. 144. Didn't you say to him, in terms or in substance, that Tweddle was always trying to get a nicer lubricating oil but this last 18-months oil is an entirely different thing from anything he had got before; that is, before you went to the Aladdin, which was a long time after 1867, he never made anything like it?

Ans. No, sir; I did not say anything of the kind to him. I remember saying to him that he pressed the paraffine out of his oil now.

Cross-int. 145. Did you make for him a little sketch of the interior works of the first still put up by Dr. Tweddle in 1867?

Ans. I did not; but he undertook to make one himself as I explained to him about the pipes in the still.

Cross-int. 146. Didn't you say to him, Mr. Abbott, in terms or in substance, that all the lubricating oil that Tweddle ever made in that still was dark-green?

Ans. I did not.

Cross-int. 147. Did you not say to him, in terms or in substance, that all the lubricating oil he made in that still had a smell, but the smell was not as strong as the crude oil that is sold as lubricating oil—what was left in the still after the refined oil was carried over—and that he drew it off from the bottom of the still, and that he did nothing more to it; that this was the only lubricating oil he made; that there would be a difference, the lots would vary a little, but he never had anything near like the sample Mr. Abbott showed you till eighteen months since?

Ans. Part of that question I can answer and part I cannot. I can answer that part of the question relating to the green lubricating oil, or the residuum left in the still. After the other oil was taken or distilled off it we run it into a receiver, and did nothing more to it, as a general thing.

Cross int. 148. The question is not what you did, but what you told Mr. Abbott at the interview at the hotel. Will you hear the preceding question read again, and state whether or not you did, either in terms or in substance, what is stated in that question?

Ans. I remember of telling him in the room that Tweddle did not make a great deal of that yellow oil in 1867. But he was making quite

a lot of Eclipse lubricating oil that he then sold, and that what he then called his Eclipse lubricating oil, he run into the receiver out of the still, and he did not do anything more with it as a general thing.

454 Cross-int. 149. Will you state whether you did or not say to Mr. Abbott, what is contained in the 148th cross-interrogatory?

Ans. I did not.

Cross-int. 150. Did you not, at the subsequent interview with Mr. Abbott, on that day, tell him, in terms or in substance, that you did not dare to tell him any more; that you would not go back of what you had told him; that you would not lie; but that you did not dare tell any more truth?

Ans. I did not tell him that I should not dare tell any more truth. I did tell him that I would repeat over again what I had already told him. I did not tell him in the words in the question.

Cross-int. 151. Did you tell him in substance what is contained in the question?

Ans. I told him in substance as I have already answered.

Cross-int 152. Did you tell him that the oil men were all leagued together, and that you would be turned out of work all round if you let out on Dr. Tweddle?

Ans. I did not.

Direct examination resumed.

Int. 1. When this Mr. Abbott, if that is his name, came to see you last March, near the Brilliant Works, to get you to go to Pittsburg with him, did he give you his name, or his residence, or his business, or any information about himself? If so, state it.

Ans. He did give me neither, further than his business. He said he wanted with me to examine these papers which he had. That's all I knew of him.

Int. 2. Did he then, or at any time afterwards, show you any such drawings or specifications as he said he had to show you?

Ans. He did not.

Int. 3. Will you describe, as well as you can, his personal appearance?

Ans. He was a man about 50 or 55 years of age, I should judge; probably not more than 50. He wore gray-colored clothes at that time, and a hat that near corresponded with his clothing. His hair was a little mixed with gray. He was a little round-shouldered, I believe, and walking on the street he walked pretty fast; seemed to like to jump
455 along the street instead of walking; one shoulder was a little higher than the other, I thought. He wore spectacles. He seemed to have rather small eyes, I think, too, to look through them. That's about all I remarked at the time. I should know him if I saw him again.

Int. 4. What wages were you getting with Lockhart & Frew at the time of this interview at the Union Depot Hotel?

Ans. I was then getting what I considered pretty small wages, two dollars and a half a day, a great deal less than I had been in the habit of getting.

Int. 5. Did you state to Dr. Tweddle what had passed between you and this Mr. Abbott; if so, how long afterwards did you so state it?

Ans. I remember of telling Dr. Tweddle that I had seen such a man on that same day; it was after dinner; I think it was in the afternoon I told him. I did state to him, as near as I could, what had taken place at the hotel.

Int. 6. You stated you went into Dr. Tweddle's employment July 4th, 1871. What sort of employment have you had from him?

Ans. He employed me at that time to go through the oil country and purchase his crude petroleum and ship it to him wherever I might find it.

Int. 7. Have you been employed in the same way for him ever since that time?

Ans. Yes, sir; ever since that time.

Int. 8. Did this Mr. Abbott, at either of the interviews with him that you have mentioned, say anything as to whether the money or compensation which was offered you was to come out of his pocket or not?

Ans. I understood from him that it was not.

Int. 9. Do you refer to the employment offered you at Corry, or the money offered you for that day's work, or to both?

Ans. I refer to the employment he offered me, and also that day's work.

Int. 10. You stated that you were in the employment of Brereton & Wilkins, at the Aladdin Oil Works, from the time you left Dr. Tweddle in 1868, until July 1st, 1869. Was Dr. Tweddle connected with the Aladdin Works during that time?

Ans. He was not.

456 Int. 11. You have stated that on several occasions you have burned a little benzole under the stills which the doctor put up in the winter and spring of 1868, in addition to using the superheated steam. What was the occasion of your doing so at these times?

Ans. We put it there so as we wouldn't have to stop our distillation on one occasion that our superheaters broke down, that our pipes broke down from the furnace, and it was used several times after that on the same occasion.

Int. 12. You say that you told Mr. Abbott that you thought that one of the two samples of oil that he showed you at the Union Depot Hotel had been made with fire heat; what made you think so?

Ans. I thought when I took the stoppers out of the bottles that he showed me, and smelt them, that I could detect that smell that usually comes from oil that is made by fire; but I was not positive whether either of them was made by fire heat or not. I merely gave it to him as my opinion.

Int. 13. In the distillation of crude petroleum by fire, what is the amount and character of the odor of the residuum in the still before the distillate has got down to about 43 gravity, and has begun to run yellow? I refer to distillation by fire, without vacuum.

Ans. Previous to its commencing to run yellow, after we have got the oil ran down to about that point, the oil in the still is not of an offensive odor.

JOSEPH CLARK.

The testimony of Mr. Millspaugh, which follows, was taken during a suspension of Mr. Clark's testimony, on Saturday, Nov. 25th, at 2016 Broadway, in order to suit the convenience of the witness, (Millspaugh,) by consent of counsel then present. After such suspension the testimony of Mr. Clark was resumed at the office of the Downer Kero ene Oil Co., 113 Maiden Lane, by consent of and for the convenience of counsel and witnesses, till adjourned till Monday 27th, at 10, a. m., at the Hoffman House, where Mr. Clark's testimony was resumed, and he examination closed, Causten Browne, esq., appearing for responde ts

with Mr. Bakewell, and conducting the redirect examination of the witness Joseph Clark.

WM. T. FARNHAM,
Notary and Commissioner.

457 *Deposition of Philip M. Millspaugh, taken, subscribed, and sworn to before Wm. T. Farnham, esq., notary and commissioner, Nov. 25, 1871.*

Int. 1. What is your name, age, residence, and occupation?

Ans. Philip M. Millspaugh. I am 43 years of age; I reside in New York City, 26 W. 129th street. I am in the oil business. Am general agent for the Manhattan Oil Co.

Int. 2. How long have you been engaged in the oil business, and how extensive has been your experience therein, whether as manufacturer or dealer?

Ans. I have been 23 years in the business; commenced like an apprentice and went into it, learned it, and followed it as a manufacturer, and have been also a dealer.

Int. 3. State whether or not you have dealt in lubricating oils, and to what extent, whether largely or otherwise.

Ans. I have sold, bought, and manufactured a great deal of lubricating oil in my time, not only for myself, but also for the companies I am interested with.

Int. 4. State what kinds of lubricating oils you have dealt in, and to what extent, within the last four or five years.

Ans. Within the last four or five years we have dealt in a good many kinds; taking sperm as a basis, then making other lubricating oils from such other oils as the price and trade required. We do a greater lubricating-oil business than any other three or four in the trade.

Int. 5. State what kind, if any, of petroleum-oil lubricators you have dealt in in the last four years.

Ans. We have dealt in pretty much every kind that has come before the public; have made experiments sufficient to test the different quantities of oils.

Int. 6. Do you know the Maysville lubricating oil? From what was it made and what were its characteristics as a lubricator?

Ans. The Maysville oil was made from cannel-coal; we handled a great deal of Maysville oil; we used to buy it manufactured at first, when we commenced with it; then we went to manufacturing ourselves from the crude oil; produced a paraffine oil which was a lubricating oil.

458 We used that for about three years as the principle paraffine oil that we used. Its character as a lubricator was one of the best substitutes we could get for sperm oil for compounding with animal oils. We discontinued its use from three to four years ago. The reason we discontinued its use was because we could not obtain it at a price which would warrant us to use it; it cost too much.

Int. 7. Since you have discontinued the use of the Maysville oil, which of the paraffine oils have you found to be the best substitute for sperm as a lubricator?

Ans. Dr. Tweddle's neutral oil, known as neutral topaz oil.

Int. 8. State whether you are acquainted with the paraffine lubricating oil manufactured as a deodorized oil by the Downer Kerosene Oil Co., said oil being known commercially as "Deodorized heavy hydrocarbon oil."

Ans. I have at different times bought what is known as Downer's

paraffine spindle oil. That's the oil they represented to me as their deodorized oil for machinery or spindle use.

Int. 9. State what, in your judgment, are the comparative merits of this Downer oil which you have just spoken of and Tweddle's neutral topaz oil as lubricators.

Ans. My experiments with both of them was very much in favor of Dr. Tweddle's oil as a lubricator. My experiments lasted probably for six months, working on the different grades of paraffine oils to make up my mind which would be or which was the cheapest and best oils for us to adopt as our use. The result was that I adopted the topaz oil entirely for our use.

Int. 10. State what you consider the comparative merits of those two oils as to odor.

Ans. I have seen so little of the Downer oil for the last year that I cannot carry distinctly my recollection of its odor. When I dealt in them both, I found the doctor's topaz oil very much the sweeter oil of the two, and less of the blue tinge which is common to all paraffine oils.

Int. 11. State whether or not you have dealt in Dr. Tweddle's neutral topaz oil extensively, or otherwise, during the last three years.

Ans. I should say extensively; we have bought several thousand barrels; we usually buy 500 at a time.

459 Int. 12. What do you consider to be the important requisites of a lubricating oil for machinery purposes?

Ans. Oil that will flow freest, wear longest to a given quantity, stand the most cold, and freest of gum.

Int. 13. State how in these respects the Tweddle neutral topaz oil and the Downer spindle oil, of which you have spoken, compare in your judgment.

Ans. I considered the Tweddle neutral oil much the best, or I should not have adopted it, as I had to pay more money for it.

Int. 14. You have stated that you discontinued the use of the Maysville oil on account of its high price; state whether or not there were any serious objections to it as a lubricator on account of its color or smell.

Ans. I don't think there was any objection on account of color. The odor of it was rather offensive to some. Its color, to be used as a compounder, was very objectionable.

Int. 15. Are you acquainted with Morehouse & Freeman's, of Cleveland, paraffine oil as a lubricator and compounding oil? And, if yea, state how it compares, in your judgment, with the Downer spindle oil of which you have spoken.

(Objected to by counsel for complainant.)

Ans. I knew the oil very well and have handled a great deal of it some two and three years ago, when I was making my experiments. I was making them on the different grades of paraffine oil I had settled on to use as a compounder, and for our use either Downer, Dr. Tweddle, or Morehouse & Merriam's. It is now Morehouse & Freeman. I thought there was so little difference between the Downer and the Morehouse and Merriam oil that for a year or a year and a half we used principally the Morehouse & Merriam oil.

Cross-examination by complainant's counsel:

Cross int. 1. From whom did you make your purchases of the Downer oil you have spoken of?

Ans. The principal portion we bought of their agent, the Downer Kerosene Oil Co., in Maiden Lane, N. Y.

460 Cross-int. 2. What quantities did you buy?

Ans. Five to ten barrel lots. There might have been larger lots.

Cross-int. 3. Can you tell how much in the aggregate you bought?

Ans. No; I could not.

Cross-int. 4. At what prices did you buy?

Ans. I can't tell now; I think from 50 to 55 cents. I think the last was just 52½; can't say positively. That was about a year ago.

Cross-int 5. At what prices have you bought Dr. Tweddle's oil?

Ans. Various prices; we bought it as high as 65 cents and as low as in the forties.

Cross-int. 6. What have you been paying during the last year?

Ans. I don't like to answer unless I am obliged to. I don't think it's proper.

Cross-int. 7. When you say at the end of your answer to the 9th direct interrogatory, "the result was that I adopted topaz oil entirely for our use," do you mean use for compounding with other oils?

Ans. Of course. I mean as a compounder we adopt it for our own use.

P. M. MILLSPAUGH.

461 *Deposition of Daniel J. Goss, taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, Dec.* 7, 1871.

Int. 1. State your name, age, residence, and occupation.

Ans. Daniel J. Goss; age, 39 years; residence, Hyde Park, Mass.; occupation, oil-dealer, doing business in Boston; of the firm of "D. M. Yeomans & Goss," defendants in this suit.

Int. 2. When did you go into business with Mr. Yeomans?

Ans. The 1st of December, 1867.

Int. 3. At that time how was the extra lubricating oil of Yeomans & Goss compounded?

Ans. It was one-quarter filtered oil, one-quarter tallow oil, and one-half paraffine oil.

Int. 4. After this, and about how soon after this, was the proportion of filtered oil changed?

Ans. I should say within three or four months. It was lessened within three or four months.

Int. 5. Did you afterwards cease altogether to put in filtered oil; and, if so, when was that?

Ans. I should say it was from the middle to the last of 1868, to the best of my recollection.

Int. 6. Was the proportion of filtered oil diminished gradually from the time you began until you ceased to use it?

Ans. It was gradually diminished after the first two or three months after I went there.

Int. 7. During the time of which we have been speaking, what paraffine oil did you mainly use in making your extra lubricating oil?

Ans. We used Coffin's largely; Lincoln's some.

Int. 8. Why did you use the filtered oil in the first place, and why did you gradually diminish its use until it ceased?

Ans. Because we believed it a good lubricator. We diminished
462 it because, after trying the experiment, we found that the oil answered the same purpose with our customers, and we were able to make it cheaper by changing the mixture—the proportion.

Int. 9. During the time you were so diminishing the proportion of

filtered oil, how were the paraffine oils you were using going on in character?

Ans. They were improving.

Int. 10. Do you know the paraffine oils of Libby & Clarke, Richardson, and Flanders, as they have been sold during the last three or four years?

Ans. Yes, sir.

Int. 11. How do they rank as paraffine oils?

Ans. We have always regarded them inferior oils—of low grades.

Int. 12. State, if you know, whether the sales of Libby & Clark's oil in this market have been increasing or diminishing the last three or four years, and how much.

Ans. I should say that they had increased very largely indeed, to the best of my knowledge.

Int. 13. You have yourselves sold their oil during that time, have you not?

Ans. Yes, sir.

Int. 14. Is your firm selling now a lubricating oil which you call neutral oil?

Ans. Yes, sir.

Int. 15. Do you sell it under that name mixed or unmixed? I suppose it to be a paraffine oil.

Ans. Both mixed and unmixed. It is a paraffine oil.

Int. 16. Whose make of paraffine oil is it?

Ans. Wm. Lincoln & Co., East Cambridge.

Int. 17. When you say mixed, do you mean mixed with fatty oil?

Ans. Yes.

Int. 18. How long have you been selling mainly this neutral oil, so called?

Ans. For a year or two.

Int. 19. Has it been your principal extra lubricating oil during the last year?

Ans. Yes.

463 Int. 20. State, as nearly as you can, how much of that oil, taking the paraffine oil unmixed, and mixed with fatty oils, together, your firm have supplied for mill use during the last twelve months.

Ans. Well, say 600 barrels.

Int. 21. What has been the result of its use in mills, so far as you know?

Ans. I should say it had been wonderfully successful.

Int. 22. Have you had any complaints from the mills which have used it?

Ans. I don't remember of a complaint. Still there may have been.

Int. 23. Into about how many mills have you introduced that oil; and what kinds of mills have they included?

Ans. We have introduced into about every mill that we have any trade with for that class of oils, including cotton and woollen mills.

Int. 24. What proportion of Dr. Tweddle's oil have you used for the last year, as compared with Lincoln's?

Ans. Scarcely any.

Int. 25. Have you used Lincoln's oil in preference to Coffin's during the last twelve months? If so, what has led you to do so?

Ans. The preference has been either an advantage in the terms, or a personal preference as between the two manufacturers.

Int. 26. Mr. Yeomans has testified that about 1866 railroad companies and some machinists commenced using the native petroleum oils as

they came from the wells, for lubricating, and that such use of those oils has continued, to a very large extent, to the present time. Of which of the native petroleum is that true?

Ans. West Virginia.

Int. 27. Was there also an oil known as the "Mecca" oil in this market at one time, which was used as a lubricator?

Ans. Yes, sir. That came from Trumbull County, Ohio. It was used on railroads in the West, prior to 1866, to my knowledge. Very little has come into this market of late. It has been produced in very small quantities of late.

Int. 28. What is the peculiarity of these West Virginia and Mecca oils which have enabled them to be so used in their native state for lubricating?

464 Ans. They are heavier gravity oils than other earth oils and natural lubricators, as we regard them.

Int. 29. What are the gravities of these two oils?

Ans. West Virginia 29 to 28; Mecca 24 to 25.

Int. 30. For what purposes have they been used as lubricators—on what kinds of machinery?

Ans. The bulk of the native oil that is used is on railroads, steamboats, saw-mills, and iron-mills.

Int. 31. Has it been used or is it available for spindle use in cotton or woollen mills?

Ans. I don't think it has been so used, or is adapted to it.

Cross-examination by Chauncy Smith, esq., counsel for complainant:

Cross-int. 32. About what has been the range of prices that you have paid for Libby & Clark's oil during the past year?

Ans. From 25 to 30 cents a gallon.

Cross int. 33. About what prices have you paid for Lincoln & Co.'s?

Ans. About 35 cents.

DANIEL J. GOSS.

Deposition of Thomas H. Young, taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, December 7, 1871.

Int. 1. State your name, age, residence, and occupation.

Ans. Thomas H. Young; 30 years old; residence, South Boston, Mass.; occupation, oil business.

Int. 2. Are you mixer of oils for Yeomans & Goss, the defendants?

Ans. Yes, sir.

Int. 3. How long have you been so?

Ans. Very nearly four years—since 14th March, '68.

Int. 4. When you began with them, what did they use to make what they called their extra sperm lubricating oil?

Ans. Paraffine oil, extra filtered oil, and tallow oil.

465 Int. 5. What paraffine oil were you then using for that purpose?

Ans. Coffin's.

Int. 6. What percentage of the three oils put in did you use at first?

Ans. Half paraffine, a fourth tallow, and a fourth filtered.

Int. 7. Did you afterwards gradually diminish the properties of filtered oil, and finally discontinue it?

Ans. I think we did. Yes.

Counsel for complainant declines to cross-examine.

THOMAS H. YOUNG.

Deposition of Charles C. Southard, taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, Dec. 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. Charles C. Southard; age, thirty-seven years; residence, Boston, Mass.; occupation, oil dealer.

Int. 2. How long have you been an oil dealer, and in what oils have you dealt during that time?

Ans. Since 1852; I have dealt principally in sperm, whale, and lard oil.

Int. 3. What description of sperm oil is used for lubricating machinery?

Ans. Principally pressed oil, or manufactured oil, as it is termed.

Int. 4. Have you prepared from your books a statement of the prices of manufactured sperm oil, as they averaged each year, beginning in 1861 and ending with 1870?

Ans. I have; they are as follows: In 1861, $1.41; in 1862, $1.55; in 1863, $1.78; in 1864, $2.06; in 1865, $2.32; in 1866, $2.62; in 1867, $2.57; in 1868, $2.11; in 1869, $1.92; in 1870, $1.52.

Counsel for complainant declines to cross-examine.

CHARLES C. SOUTHARD.

466 *Deposition of David M. Yeomans, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, Dec.* 13, 1871.

Direct examination by Causten Browne, esq., counsel for respondents:

(It is admitted that this witness, if examined, would testify substantially as testified by Daniel J. Goss, as to the matters covered by the direct examination of said Goss from the 10th interrogatory inclusive.)

Int. 1. Do Lincoln & Co. sell their neutral oil to customers?

Ans. No, sir, I believe in no case. None that I know of.

Int. 2. Is that a matter of agreement by them; if so, with whom?

Ans. It is a matter of understanding between them and ourselves, that they will not sell to consumers.

Int. 3. Does your firm take all of Lincoln & Co.'s neutral oil?

Ans. No, sir.

Int. 4. State the limits of the prices that you have received during the last year for the neutral oil manufactured by Lincoln & Co. and sold pure by you.

Ans. From forty-two to sixty-five cents per gallon. We have a contract with one mill for forty-two.

Int. 5. Does this oil of Lincoln & Co. continue to be made by the common process of manufacturing paraffine oil?

Ans. So far as my knowledge extends, it does.

Int. 6. What knowledge have you about it?

Ans. Examination of his works, and Mr. Lincoln's statements to us.

Cross-examination by Chauncey Smith, esq., counsel for complainant:

Cross-int. 7. What is the name of the mill with which you have a contract for the Lincoln oil at forty-two cents per gallon?

Ans. The Peabody Mills at Newburyport.

Cross-int. 8. What quantity have you supplied at that price during the last year?

Ans. I should say about twenty-five barrels.

Cross-int. 9. What quantity have you sold during the past year at sixty-five cents, and to what parties?

Ans. It was to one of two mills—either the Langdon, or the
467 Stark at Manchester; I can't tell which without referring to my books. I should say fifteen or twenty barrels. We have sold single barrel lots also as high as that, but I couldn't say to whom, I'm sure.

Cross-int 10. Will you furnish the complainant with a gallon of this neutral oil of Lincoln's?

Ans. I will.

D. M. YEOMANS.

Deposition of James A. Treat, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, March 1, 1871.

Direct examination by Causten Browne, esq., of counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. James A. Treat; age, 64 years; residence, Lawrence, Massachusetts; occupation, dealer in manufacturers' supplies.

Int. 2. When you were on the stand as witness for the complainant, you testified that Merrill's wholesale price for his deodorized oil, so-called, was sixty cents. Do you buy that oil direct from him or the Downer Co.?

Ans. I do buy it direct from the Downer Kerosene Oil Co.

Int. 3. Have you invariably paid sixty cents for that oil?

Ans. Yes, sir; I have for the last two years. That is his price and that is the way his bills are made out, although there is a small commission to me for selling. That was the price prior to January 26, 1871.

Int. 4. What has been his price since then?

Ans. Fifty-five cents.

Int. 5. What is the rate of commission allowed you, as just mentioned?

Ans. That has varied. It never exceeded five cents per gallon.

Int. 6. You testified in answer to the question "whether or not your customers like Maguire's wool oil as well as the pure olive oil formerly used,"—"They not only like it as well, but many of them prefer it." Will you give the names and residences of the customers to whom you have sold Maguire's wood oil, with dates and amounts?

468 Ans. I have sold the wool oil to the Arlington Mills, at Lawrence; the Pemberton Mills, Lawrence; Ballardvale Mills, at Ballardvale, Andover; S. Robinson & Co., at Lawrence, Mass.; Methuen Woollen Mills, at Methuen, Mass.; and small quantities to various other parties, among them, I think, N. Stevens and Sons, of North Andover; the Great Falls Woollen Manufacturing Co., at Great Falls, N. H. This last was sent either by me or Mr. Maguire, I can't say which. I don't think of any others. The dates and amounts of sales to the first five customers are to be found in the paper annexed, marked "Exhibit Respdt. 29a."

Int. 7. When you say that many of your customers prefer the Maguire oil to the pure olive oil formerly used, do you mean that they prefer it as being cheaper or as being better, or both?

Ans. I mean as being cheaper, and. in some cases, better than the olive oil they now get, or generally find, in the market.

Int. 8. Will you name those customers who have preferred it as being better than the olive oil they now get in the market?

Ans. I don't know as I have any particular party in mind, only from general expressions and a continuation of sending their orders.

Int. 9. Is the olive oil now found in the market inferior for wool purposes to what it used to be?

Ans. Pure olive oil is not, so far as I know.

Int. 10. Is the olive oil now found in the market pure?

Ans. From the general complaints that I hear of its adulteration, I should think not.

Int. 11. Of whom do you buy your olive oil?

Ans. I've bought the most of Francis Maguire.

Cross-examination declined.

JAMES A. TREAT.

"*Exhibit respondent, 29a.*"

April	11,	1870.	Amt.	coal	oil	bought		43^3
May	3,	"	"	"	"	"		48
"	18,	"	"	"	"	"		137
July	1,	"	"	"	"	"		142^2
"	22,	"	"	"	"	"		46^2
469 Aug.	16,	1870	amt.	coal	oil	bought		47^2
"	25,	"	"	"	"	"		233
Sept.	6,	"	"	"	"	"		90^2
"	16,	"	"	"	"	"		45
Oct.	13,	"	"	"	"	"		46^2
"	25,	"	"	"	"	"		44^2
Nov.	1,	"	"	"	"	"		45^2
"	10,	"	"	"	"	"		91^2
Dec.	1,	"	"	"	"	"		42^2
"	6,	"	"	"	"	"		42
"	28,	"	"	"	"	"		46
Jany.	4,	1871.	"	"	"	"		139
"	21,	"	"	"	"	"		41
Feby.	17,	"	"	"	"	"		44
								1,416

To whom sold:

Arlington Mills.
Methuen Woollen Mills.
Ballardvale Manufacturing Co.
S. Robinson & Co.
Pemberton Co.
Small quantities to some others.

Deposition of Eben N. Horsford, taken, subscribed, and sworn to before N. Austin Parks, esq., examiner, January 6, 1872.

Direct examination by Causten Browne, esq., of counsel for respondents.

(Counsel agree that this deposition may be taken and used as if taken in due time.

Int. 1. State your name, age, residence, and profession.

Ans. Eben N. Horsford; I reside at Cambridge; am 53 years of age, and a chemist by profession. I was for sixteen years Rumford professor at Harvard College, and lecturer upon the application of science to the

470 useful arts; also, instructor in analytical chemistry, and chemical research in the Lawrence Scientific School.

Int. 2. I understand the invention of the plaintiff in this case to relate to the deodorization of heavy hydrocarbon oils by removing from them, by distillation, the light and more volatile oils with which they are associated. Are these light and more volatile oils convertible into vapor at a lower temperature than the remainder of the oil, and is such vapors inflammable?

Ans. They are convertible into vapor at lower temperatures than the residue of the oil, and the vapor are inflammable.

Int. 3. Do these light and more volatile oils comprise or include different gravities Beaumé?

Ans. They do.

Int. 4. How does this appear?

Ans. Mainly by the circumstance that they volatilize at different temperatures.

Int. 5. Have you recently made an experiment with the Merrill deodorized oil, so-called, and with certain other paraffine lubricating oils, to determine the temperatures at which such inflammable vapors were yielded by them respectively; if so, will you state what oils you included in the experiment, and all the particulars of your method of trial and results?

Ans. I have recently made such experiment. I took equal quantities by volume of the following oils: Merrill's deodorized oil, received from John R. Bartlett in October, 1870, marked "Exhibit 87;" Coffin's medium oil, received from Mr. Bartlett, February 11th, 1871, Exhibit 88; Maysville oil, bearing this label: "Pure Maysville paraffine oil—Summer; W. M. Bailey, Providence, received from J. R. Bartlett, February 11th, 1871," Exhibit 89; Seccomb, Kehew and Thayer, paraffine oil, 32 gravity, from John R. Bartlett, February 11th, 1871, Exhibit 90; Lincoln's neutral oil, received January 3d, 1872, from the clerk of Mr. Browne, and bearing the initials D. J. G., Exhibit 91.

These equal qualities, which were about a quarter to a third of an ounce each, were placed in glass test-tubes, such as are in common use in laboratories of uniform diameter, selected for the experiment, which test-tubes were filled to about one quarter of their depths. These test-tubes were then placed erect upon a fold of paper in a Becker glass,

471 containing melted paraffine, which extended above the surface of the oil in the test-tubes about an inch and a half, which was nearly the height, but not quite, of the oil in the test-tubes. The paper served to prevent contact with the bottom of the Becker glass, and acted merely as a cushion. The test-tubes were so close together as to admit of but little motion, and were placed around the circumference of the interior of the Becker glass, and were all of them surrounded by the melted paraffine. A centigrade thermometer of high range was suspended a short distance above the bottom of the Becker glass, so that the bottom of the bulb was at a distance of about two inches from the top of the melted paraffine, and the bulb and the graduation for some distance above were immersed. The Becker glass was seated upon a sand bath, heated by a moderate flame from a Bunsen's burner. The graduation of the thermometer was distinctly visible from the temperature of boiling water upwards above the tops of the test-tubes.

The object of my experiment was to determine the flash-point in each of the several oils. The point of flame used was obtained by lighting the end of a slender strip of bamboo. The conditions of the experiment were such, that any vapor evolved from the oils would accumulate

in the space above the oil and below the level of the surrounding melted paraffine. And when, as a consequence of the increased temperature, a depth of vapor of half an inch, for example, or even less, had been produced, upon inserting the point of flame into the tube, and lowering it to the surface of this vapor resting upon the oil, the vapor would take fire. And the temperature at which this firing first occurred would be indicated by the thermometer, the testing being made at intervals either of so many degrees of the rising thermometer or so many minutes of time. The smoke resulting from the introduction of the taper into the tube must necessarily be removed by directing a jet of air into the tube, and this was done in every experiment immediately after the flame-point was introduced; a brief interval of perhaps a couple of minutes (sometimes less, but with all the tubes the same) elapsed after the blowing in of air to remove the smoke of the previous experiment before the point of flame was introduced to find the flash-point. The experiments conducted with the aid of this apparatus, and by this process, thus described, gave for the lowest flash-point for each of the oils, the following
472 results, converting the centigrade degrees into Fahrenheit. Seccomb, Kehew & Thayer oil, 248° F.; Maysville summer, 257° F.; Lincoln (meaning by that the oil from the vial marked "D. J. G.,") 275° F.; Coffin's medium, 285° F.; Merrill's deodorized oil, 295° F.

These experiments were made day before yesterday, and were repeated that day and yesterday; and with the exception of the Lincoln oil, had been also made several months ago. The jet of air to remove the smoke of each previous experiment was introduced by blowing through a glass tube.

Int. 6. It is stated by Mr. Hayes, an expert witness for the plaintiff, that in the common petroleum of this country, such as comes from Pennsylvania, for instance, there is no paraffine. State any fact within your own knowledge, showing whether or not Mr. Hayes is right.

Ans. In 1837, I collected from the surface of the Cuba Oil Spring, in Alleghany County, N. Y., a sample of the oil. The product of this spring, which is spontaneously evolved, had long been known to the inhabitants of Western New York, and more especially to the Indians, and was in popular use as a healing agent, in cases of bruises and chafing, under the name of Seneca oil. I collected about a gill, or a little more, perhaps, and bottled it up, and corked it, and have preserved it till now. After a while there appeared at the bottom of the bottle a quantity of reddish matter, the liquid above being of a clear amber color; and, at a later period, white flocculent matter began to separate, but precisely when it began I cannot say. I first observed it about twenty-four years ago, which time I fix by the circumstance of moving to Cambridge my collections, and arranging them there. The flocculent matter had very considerably increased eight years ago, when I had occasion to look at it on removing from one residence to another in Cambridge, and it has gone on to increase since then, as I observed it when my attention was directed to this case by Dr. Tweddle, some twenty months ago. I have the sample here, but do not wish to part with it. I have, however, taken a section of the fluid from the sample, as nearly as I could, by introducing an open tube carefully and slowly to the bottom, closing the top, and withdrawing the tube and its contents, and then preserving the portion so extracted. This exhibit is marked "E. N. H. 1;" and also "Exhibit 92, N. A. P., Ex'r."

The white suspended material readily melts on the application of heat. It readily dissolves in naphtha, and re-appears on the evaporation
473 of the naphtha. These are evidences of its character, as the

same effect will be produced by treating pure paraffine in the same way. The cork with which the bottle was stopped when the oil was collected was sealed with sealing-wax. In attempting to remove the cork, I found the sealing-wax was quite viscid, showing that there had escaped from the bottle some volatile hydrocarbon gas, which had acted on the sealing wax to give it this viscidity. It is, I think, fair to infer that the escape of this volatile hydrocarbon had deprived the oil of its capacity to hold paraffine in solution at ordinary temperature. And no other change has taken place of which I have any knowledge in the sample which I have submitted. It seems just to conclude, therefore, that the paraffine existed normally in the sample of oil which I collected from the Cuba Oil Spring in 1837.

The position of the Cuba oil spring, geologically considered, is the same as that of the oil springs in the northern part of Pennsylvania.

Cross-examination by Chauncey Smith, esq., counsel for complainant:

Cross int. 7. Are the results which you have given as to the flash point of the several oils you have experimented with, the mean of your several experiments?

Ans. No; the lowest.

Cross int. 8. Will you give the results of the other experiments?

Ans. I remembered to have observed this, that if the vapor is allowed to accumulate by gradual rises of temperature in one case, and produced by sudden rise in another, there is a difference between them. My object was in all cases to get the lowest flash point, distinct flash, about which there could be no doubt.

Cross-int. 9. In this experiment, the results of which you have given, how long a period elapsed between the trials of the vapor with the point of flame, and through how many degrees did the thermometer rise during those intervals?

Ans. The observations were first made once in five degrees centigrade, until the first flashing began, that is, until the first one of them flashed; and I should say until the second one flashed. I am now thinking of the observations of day before yesterday and yesterday. After the second one flashed, the observations were made once in from two to three degrees of the thermometer. It was impossible to be absolute in
474 either times or temperatures, as it was necessary to blow out the smoke, and to get a proper flame point, so as to prevent any fragments of coal from dropping from the end of the burning taper. In these experiments of day before yesterday, I think the time in the latter part of the observations was not more than two minutes, generally. In my earlier observations of some months ago I took distinct intervals of time, having adjusted the flame under the sand bath, and marked the temperature at what it happened to be; in the first place, determining the flash point as I went up, and in the second place heating them up to a temperature above that at which they all flashed, and then testing them as the temperature fell, having withdrawn the heat.

(The question being repeated, and the attention of the witness called to the fact that the inquiry relates to only one experiment, he says:)

I should say the intervals in temperature were from three to six degrees Fahrenheit, and the intervals in time, which I did not note, from two to three minutes, I should judge.

Cross-int. 10. You speak of observing a difference in the flashing points, depending upon the circumstances that the vapors were suffered to accumulate over the surface of the oil more or less rapidly. In which case did you obtain the lowest flashing point?

Ans. I should say (as I recall it without distinct recollection now) that it was where the rise in temperature was slow. I think it is proper to add that this statement of a general truth does not necessar'y apply to experiments made at the intervals mentioned in answer to the last question.

Direct examination resumed:

Int. 11. Why did you suffer a difference of time between each experiment with your flame point and its immediate predecessor or successor; and how does such difference affect, if at all, the accuracy of the results obtained, and stated by you in your direct examination?

Ans. The time was about as brief a time as was practically possible, my object being to catch the lowest flashing point, blow out the smoke, and record the observations. By prolonging the time the temperature would necessarily rise, and in an experiment in which more time was allowed to elapse than was absolutely necessary, a higher temperature would be indicated than was justly due to the flash point. The difficulty in reaching the absolutely lowest point arises from two or
475 three considerations, which I will mention. The distance from the top of the tube to the surface of the liquid is about four inches. If the point of flame is held at such a distance from the thumb and finger as to come very near the surface, where a sufficient accumulation of vapor has taken place, the experiment will succeed the first time. If the distance between the point of flame and the thumb and finger is less than this required distance, the flame will not reach the inflammable vapor. If the fibre of the taper is too slender, the taper will burn to coal near the point and the flame retreat up the taper so as to be out of the range of the inflammable vapor. If the distance be a little too great, the end of the taper will reach the oil and defeat the experiment. Between each two experiments with the same oil the smoke must be blown out; and during the time the experiments are making with these variations, the temperature all the while rising, the just flashing point could be passed.

E. N. HORSFORD.

Agreement as to testimony of John R. Bartlett, etc.

John R. Barlett will testify that the "Coffin medium oil," mentioned in Horsford's deposition as obtained from him, February 11th, 1871, was delivered by him to Horsford on that day, having been previously obtained by him (Bartlett) from Charles F. Coffin, who will testify that said oil was so delivered by him to Bartlett after January 28, 1871, and before February 11, 1871, and was a sample of his medium or once-refined paraffine lubricating oil, manufactured by the process described by him in his deposition given January 28, 1871.

John R. Bartlett will also testify that the Maysville paraffine oil mentioned in Horsford's deposition as obtained from him February 11, 1871, was taken from a can of oil sent to him by express by W. M. Bailey, in pursuance of said Bailey's promise, made at the time of giving his deposition in this case, to send a can of the Maysville oil, referred to therein, to him (Bartlett) and a can of the same oil to the complainant.

John R. Bartlett will also testify that the Seccomb, Kehew & Thayer oil, mentioned in Horsford's deposition as obtained from him
476 February 11th, 1871, was delivered to him shortly before that date by said Thayer, who will testify that the same was a sample of the 32° gravity paraffine lubricating oil made and sold by his said firm, as testified in his deposition in this case.

John R. Bartlett will also testify that the "Merrill deodorized oil," so called, mentioned in Horsford's deposition as obtained from him in October, 1870, was obtained by him shortly before that time from Seccomb, Kehew & Thayer, or from the respondents, Yeomans & Goss—he cannot say which, because he had a quantity of oil from each of these firms—represented by them to be "Merrill deodorized oil," so called, manufactured and sold by the Downer Kerosene Company; and Mr. Thayer will testify that his firm had and Mr. Yeomans will testify that his firm had a barrel of "Merrill deodorized oil," so called, which they bought from the Downer Kerosene Company since this suit was commenced, and from which barrel they furnished a small quantity to said Bartlett before October, 1870, and that they furnished to him but one lot of oil represented to be Merrill oil.

J. Henry Taylor, clerk of Mr. Browne, will testify that the bottle of oil mentioned in Horsford's deposition as obtained from him January 3d, 1872, was obtained by him about January 1st, 1872, from Daniel J. Goss, respondent, who will testify that he so gave it to him, and that it is a sample of the Lincoln paraffine lubricating oil manufactured by Mr. Lincoln, and sold by the defendants, as testified in the deposition of Goss and the last deposition (Dec. 13, 1871) of Yeomans.

BOSTON, *January 11th*, 1872.

The complainant agrees that the persons above named would, if called as witnesses, testify as above stated, and that the above may be read in evidence on behalf of the defendants.

CHAUNCEY SMITH,
For Complainant.

477, 478 *Deposition of Wm. D. Philbrick, taken before H. Farnam Smith, special examiner, Wednesday, January 24, 1872.*

Direct examination by Walter Curtis, esq., in behalf of the plaintiff:

Int. 1. What is your name, age, residence, and occupation?

Ans. William D. Philbrick; age, 37 years; I reside at Newton Centre, Massachusetts; I am a market gardener.

Int. 2. State whether or not you were at one time engaged in the manufacture of oils from petroleum; and if so, where, and how long, and to what extent.

Ans. I was, at East Boston, Mass., for about four years previous to January, 1866; we manufactured largely—from fifty to one hundred barrels a day.

Int. 3. What was the character of the oils produced at your works—whether lubricating or burning oil, or both? Please describe the process by which they were produced, from the time you first became connected with the manufacture.

Ans. Both. The process consisted in the first place of distilling crude petroleum. The distilled oil was separated into three different products—the first that came over being called naphtha, the second burning oil, and the last, heavy or lubricating oil. These oils after distillation were subjected to a purifying process, which consisted of agitating them with sulphuric acid, and afterwards with caustic soda; afterwards washing with water. The burning oil was sometimes exposed in tanks in the sunlight, with a glass roof over them similar to a greenhouse roof.

Int. 4. State whether it was the design and purpose of the process

carried on at your works to produce the largest quantity of lubricating or of burning oil obtainable from the crude material.

Ans. That would depend upon the market price of the several articles. Nearly always, I think, the price for burning oil was higher than that for lubricating oil, and always higher than that for naphtha; so we tried to make as much burning oil as possible.

Int. 5. Please describe the apparatus in which the distillation was
479 carried on, as conducted at your works during the earlier period of your connection with them.

Ans. It was simply an iron still set in brick-work, holding from one to three thousand gallons; we had nine or ten of these stills; crude oil was run directly into them until they were nearly full. The still was closed up, and a fire kindled under it; a very gentle fire at first, increasing the fire as the process continued. It was the ordinary process of distillation as carried on at that time in all works that I knew anything about.

Int. 6. Whether or not the products were distilled over into the condenser until the still was run to dryness?

Ans. That was our custom.

Int. 7. What was the character of the lubricating oil which you produced, as to color, odor, and body? I mean the finished article sold by you in the market.

Ans. It was of a dark yellow color, somewhat brownish. The odor was variable, and that caused us a good deal of annoyance—we couldn't depend upon getting it of a uniform odor. It is difficult to describe it. It was an odor peculiar to that product. It was penetrating and peculiar. In regard to body the oil was much heavier than the burning oil and like the body of fat oils, such as tallow and lard and sperm oils. It was used by our customers for mixing with fat oils.

Int. 8. Whether or not you were familiar with the oils produced at the same period by the Downer Kerosene Oil Company; and if so, how did their lubricating oil compare, in the above respects, with the oil which you made?

Ans. I was familiar with it. The oil of the Downer Company was uniformly of a better color, better odor, and better body.

Int. 9. Whether or not Mr. D. M. Yeomans was connected with the sale of your oils at any time; and if so, when, and for how long?

Ans. He had an agency for the sale of our products for about six months, in 1865. That is the firm of which he was a member—the firm of Smith & Yeomans.

Int. 10. If at any time you made use of a different apparatus for the purpose of producing lubricating oil, from that which you have before described, state the period when you used it and what the apparatus was.

480 Ans. We experimented with a patent still during the autumn of 1865. It was a still for fractional condensation. It was heated by superheated steam only. The vapors of the crude petroleum were lifted in a mixed state and separated in condensation by different condensers. It was a very troublesome apparatus, and never worked successfully in a practical manner.

Int. 11. How was the crude petroleum introduced into the still and exposed to the action of the heat?

Ans. It was made to pass first around the condensing pipes in the condensers, where it was partially distilled. It then entered the still itself and encountered the superheated steam, the steam being introduced by a perforated coil. The steam was also made to pass around

the still in a jacket. A part of the oil that was not carried over by the steam remained, and was drawn off from time to time, and was called residuum.

Int. 12. Did the crude oil flow continuously into the still, or did it drop into it?

Ans. It flowed continuously by a small stream.

Int. 13. Whether or not it distilled over nearly as rapidly as it flowed in?

Ans. It distilled nearly as rapidly, the balance being residuum.

Int. 14. What I desire to enquire is, whether the process carried on was a form of continuous distillations, or whether you filled the still up with crude material before the distillation commenced?

Ans. The intention was to have it a continuous process. It was, however, subject to many interruptions, owing to the imperfections of the apparatus.

Int. 15. What was the character of the residuum, and for what uses was it available?

Ans. It was a dark-green, viscid substance, salable in small quantities for axle-grease.

Int. 16. Whether or not the percentage of residuum which this apparatus yielded was large in proportion to the amount of oil produced?

Ans. It was too large for a profitable business.

Int. 17. I understand you to say that superheated steam was used alone in this still, without any fire. Is that correct?

Ans. Yes, sir.

Int. 18. What was the character of the burning oil which you produced by means of this still?

481 Ans. It was a better article than we could make by the old process.

Int. 19. What was the character of the lubricating oil produced, and how uniform in character did the different lots produced prove?

Ans. It produced small quantities of a superior quality. The different lots were not uniform. It could not be relied upon. A large percentage of the heavy oil passed into the residuum.

Int. 20. Compare the best lubricating oil which you produced from that still with the Downer oil then in the market, as to color, body, and odor, and state, if you know, how the prices at which you sold your oil compared with the prices of the Downer Company for their best lubricating oil.

Ans. My impression is that as regarded color and odor it compared favorably, but it was not of so good a body. I don't remember as regards price. There was so little of it produced that it made no impression upon my mind.

Int. 21. Do you think that your lubricating oils made at this period brought generally higher prices than that of the Downer Company?

Ans. We made very little, except by the old process. This we were obliged to sell at prices considerably under Mr. Downer's, and frequently we redistilled them to make burning oil of them.

Int. 22. Are you acquainted with Merrill's patent deodorized oil? and if so, please compare that oil with the lubricating oil made in the patent still at your works, as to color, body, and odor.

Ans. I have seen samples of it. I think the odor and color are superior to anything we made. The body appears to be better also, but that is a matter to be tested by experience. I cannot judge of it, having never tested it.

Int. 23. When did you discontinue the business of manufacturing oils, and for what reason?

(Objected to.)

Ans. In February, 1866, on account of the insolvency of the firm of Philbrick & Parsons.

Int. 24. Whether or not such lubricating oil as you produced in this still passed into the hands of Smith & Yeomans for sale?

Ans. It did.

482 Int. 25. Are you able to state approximately the quantity of lubricating oil you made in this still? What is the best of your recollection on the subject?

Ans. I don't recollect distinctly, but my impression is it was less than fifty barrels.

Int. 26. Taking the general result of the use you made of this still, did it prove to you to be profitable or otherwise?

Ans. We found it entirely unmanageable and useless.

Int. 27. Prior to engaging in the manufacture of oils what acquaintance, if any, had you with chemical pursuits?

Ans. I had been for two years assistant to Professor Cook, at Cambridge, for one year assistant to Mr. Ordway, at the Roxbury Chemical Works, and for two years manufacturing chemicals on my own account.

Adjourned.

FEBRUARY 24, 1872.

And in answer to cross-interrogatories by Causten Browne, esq., of counsel for respondent, defendant saith:

Cross-int. 1. How long has the Downer Company been established in the manufacture of the various products of petroleum?

Ans. I don't know.

Cross-int. 2. Have you ever been a dealer in refined oils or paraffine oils in this market?

Ans. Only in such as I made myself.

Cross-int. 3. How long did you deal in this market in your own products?

Ans. A little over three years previous to February, 1866.

Cross-int. 4. Did you get the same price for your refined oil that the Downer Company got for theirs at the same time? By refined oil I mean burning oil.

Ans. We got about two cents less, as a general rule, than Mr. Downer's brought, from two to three cents per gallon.

Cross-int. 5. Do you know whether the other dealers in refined or burning oils in this market got about the same as you did?

Ans. There were two or three other manufacturers that got the same as we did. The western manufactured oils sold for less.

483 Cross-int. 6. What was the reason of the Downer Company's getting a higher price than any one else?

Ans. Their oil was of a more uniform character and better known. They were established earlier than most other companies.

Cross-int. 7. What patent still was it that you say you experimented with during the autumn of 1865?

Ans. It was a still patented by Prentiss & Robertson, first in England and afterwards in this country.

Cross-int. 8. About how much length of superheating pipe was there in that patent still? In the superheating furnace, I mean.

Ans. Originally, as tried, a coil which I think had about fifty feet in

it. It didn't prove sufficient, and we afterwards built a new furnace with a new patent superheater, patented by Mr. Parsons, my partners' brother.

Cross-int. 9. When did you build this Parsons superheater?

Ans. I don't recollect exactly. I think it was in November, 1865.

Cross-int. 10. How much length of superheating pipe did you have in the furnace in that apparatus?

Ans. The superheater consisted of cast-iron boxes, not of pipe.

Cross-int. 11. What temperature of superheated steam did you get in each of these apparatus?

Ans. With the Parsons machine it made the pipe red hot as it issued from the superheater. The other did not heat the steam so hot. The pipe was not red, but I can't tell any nearer what it was.

Cross-int. 12. Was the steam no hotter when it got to the jacket of the still where it could be seen?

Ans. The jacket of the still was surrounded with brick work and the pipe was red hot where it entered the brick work. That's all I can answer.

Cross-int. 13. From the point where the pipe reached the jacket of the still did it conduct the superheated steam directly into the still, or was a portion of it condensed between the jacket and the still?

Ans. The pipe branched outside of the still. One branch connected with the jacket, the other with a coil inside the still.

Cross-int. 14. What was the diameter of the still?

Ans. Eight feet spherical.

484 Cross-int. 15. What became of the steam that passed through the branch that connected with the jacket?

Ans. It passed off through a small vent pipe.

Cross-int. 16. What was the appearance of the steam as it issued from that vent pipe?

Ans. When the still was hot and in full operation it was invisible—an invisible gas.

Cross-int. 17. How hot do you suppose it was at this height?

Ans. I've no means of judging.

Cross-int. 18. Could you light a piece of wood against the extreme end of the pipe where the steam issued?

Ans. No, sir; it was not hot enough for that.

W. D. PHILBRICK.

Adjourned to Monday at ten o'clock.

Deposition of Abel W. Tripp, taken before H. Farnam Smith, special examiner, Wednesday, January 24, 1872.

Direct examination by Walter Curtis, esq., in behalf of the plaintiff:

Int. 1. What is your name, age, residence, and occupation?

Ans. Abel W. Tripp; thirty-six years of age; residence at South Boston, Mass. I am a machinist.

Int. 2. In what business are you at present engaged, and how long have you carried it on?

Ans. In building hot-air engines. I have carried the business on for about four years.

Int. 3. State what machinery you run in connection with your business of constructing these engines; and give, if you can, the speed at which your various machines are run.

Ans. Lathes, planers, drills, etc., such as are usually used in machine

shops—some run at high and some at low speed. It depends upon what use you are making of your machines. We run emery wheels and speed lathes sometimes as high as fifteen hundred or two thousand
485 revolutions a minute—usually at about that rate. Engine lathes usually not over one or two hundred revolutions a minute.

Int. 4. State, if you please, what occasion, if any, you have for using lubricating oil in connection with your business other than upon the machinery above referred to, and to what extent you have purchased it.

Ans. I use it on the engines which I build, and purchase it by the barrel, I believe.

Int. 5. Do you, or not, try the engines you build for some time before sending them out?

Ans. I do.

Int. 6. Do you, or not, furnish to your customers who purchase engines from you lubricating oil for use upon the engines which they buy?

Ans. I do.

Int. 7. What quality of lubricating oil is necessary for use upon your engines, and why?

Ans. We have to use a very good quality because the engines become very hot.

Int. 8. If the oil is of inferior quality, and the engines become very hot, what is the consequence?

Ans. It gums up—leaves a gummy, sticky substance on the cylinders, and the engine will hardly run.

Int. 9. What kind of lubricating oil do you use upon the engines at your manufactory and sell to your customers for use by them?

Ans. A mixture of sperm and Downer's lubricating oil—one-fifth sperm and four-fifths lubricating.

Int. 10. How is the Downer lubricating oil branded, if you know?

Ans. I never noticed. I usually send a cask over and have it filled. The best lubricating is what I send for.

Int. 11. How long have you been using that oil?

Ans. Some time in 1868 I began.

Int. 12. How does that oil answer when applied to the hot cylinders of your engines as a lubricator?

Ans. It does very well—next to sperm. I have never been able to make anything else work except sperm until I tried this.

Int. 13. How does the combination which you have spoken of, of one part of sperm and four parts of Downer's, answer for the purpose?

486 Ans. That is what I thought you asked me before.

Int. 14. Do you use the Downer oil for lubricating the machinery which you use in making your engines, and if so, with what results, and whether pure or mixed with sperm?

Ans. I do, sometimes pure, which works very well, and intend to use this all the time, but sometimes the boys will get into the barrel containing the mixed oil.

Int. 15. Whether or not you have tried other kinds of paraffine oil besides Downer's in combination with sperm for use on your engines, and if so, to what extent and with what results?

Ans. I have tried other paraffine oils in combination with tallow, lard, and sperm. I made several mixtures with very poor results. I couldn't make it work unless by putting on the greater part sperm, which would make it too costly; and then the poor quality of paraffine oils would have a substance that would smoke very much.

Int. 16. State, if you are able, what brands or kinds of paraffine

oils, other than Downer's, you tried, and from whom you made your purchases.

Ans. I never noticed the brands, and couldn't tell what kind. It was called the best paraffine oil. I bought some of Smith & Merrill and some of T. M. Ware & Co.

Int. 17. Whether or not you bought mixed oils and tried them, as well as mixed them yourself, and with what results?

Ans. I did buy mixed oils, and tried them with a poor result.

Int. 18. Did you try lard oil unmixed for your engines?

Ans. I have done so. It was the poorest oil we could use—gummy.

Int. 19. Are you able to state from your own knowledge what has been the experience of any of your customers in regard to the best lubricating oil for use on these engines? If so, please say what it has been, as far as you know.

Ans. Some of these first mixtures that I sold would gum up the engines very much, so that you could hardly run them. Parties using them would send for a man to come and repair the engine, and when the gum was scraped off the engine would go all right.

Int. 20. What representations are made to you by your customers as to the compound of Downer's and sperm oil, which you say you now sell?

(Objected to.)

487 Ans. They seem to like it very much.

Int. 21. At what price do you sell it to them, and to what places do you send it?

Ans. I sell it at one dollar and fifty cents, and to some customers at one dollar and thirty cents, in larger quantities generally. I send it as far as Baltimore, and Troy, New York, and various intermediate places. Some parties who have exchanged our engines for steam-engines still continue to buy the oil for the steam-engines.

Cross-examination by Causten Browne, esq., in behalf of the defendant:

Cross-int. 1. Have you here any bills of the paraffine oils which you bought before you began to buy of the Downer Company in 1868? If so, will you give the names of the sellers and the dates of the sales, and the selling price of the paraffine oil, so far as the bills show it?

Ans. I have one bill here from T. M. Ware & Co., of Boston, 256 Congress street, dated July 14, 1868, at forty cents a gallon, and another bill from Smith, Merrill & Co., dated April 23, 1868, for a mixture, and the price of the paraffine oil is not given. Caleb A. Smith and J. S. Merrill and Daniel Curry seem by the bill to have been the partners in the firm.

Direct examination resumed:

Int. 22. What did you pay the Downer Company for oil during the same year mentioned in your last answer?

Ans. I bought of Downer right away afterwards. I paid them at first eighty cents, and afterwards, when I bought larger quantities, sixty cents.

A. W. TRIPP.

Deposition of Samuel H. L. Pierce, taken before H. Farnam Smith, special examiner, Wednesday, January 24, 1872.

Direct examination by Walter Curtis, esq., in behalf of the plaintiff:

Int. 1. What is your name, age, residence, and occupation?

Ans. Samuel H. L. Pierce; age, forty-six years; residence, South Boston, Mass. I am a carpenter and builder; have a planing mill.

488 Int. 2. What machinery do you run in connection with your mill, and at what rate of speed do the respective machines operate?

Ans. I have five planing machines, several circular saws, two moulding machines, sash-fitting machines, mortising machines, and other small tools which usually go in such a place. I use a forty-horse engine. I have two planing machines, which I run up to thirty five hundred revolutions a minute; two others up to about three thousand, and a smaller one up to about twenty-five hundred revolutions. My circular saws I run up to about two thousand revolutions; moulding machines about twenty-five hundred revolutions. The others have various rates of speed; not many that run less than fifteen hundred revolutions.

Int. 3. What character of lubricating oils is necessary for use on machines running at the high rates of speed you have given above?

Ans. I have found it necessary to get something which has body to lubricate the bearing, and yet not too light, so as to fly off, and to be as free from gum as possible.

Int. 4. Whether or not you have ever used on your machinery the lubricating oil known as Coffin's oil? If so, when, and with what results?

Ans. I have, in 1869. I found it was too light. It would fly off from the cylinders, and had a good deal of odor to it, and it wouldn't wear as long as I thought it ought to.

Int. 5. Whether or not you have made use of lard oil on your machinery? If so, with what results?

Ans. I have. It didn't answer my purpose very well. I found I never could get any lard oil but what would gum up. When I first began to run the mill, about fourteen years ago, I used lard oil altogether.

Int. 6. What oil are you now using, and how long have you been using it?

Ans. I am using Downer's oil, and have been mostly for about twelve years. I have experimented a little with other oils.

Int. 7. Whether or not you have, within a few years past, noticed any change in the oil you have been purchasing from the Downer Company as to body and odor; and if so, when did you discover it, and what was the difference?

489 Ans. I have noticed a change within three or four years. When I first began to use it there was some odor to it, and not as much body as it has now. I think its wearing properties are a good deal better now than when I first began to use it.

Int. 8. Whether or not you are now using this oil only at your mill and whether you use it mixed or pure?

Ans. I use this wholly, and I use it pure.

Int. 9. How does this oil compare for use in your machinery with the Coffin oil, which you say you used in 1869?

Ans. The Coffin oil I bought by the canfull of ten gallons, and one can would run from nine to eleven days. The Downer oil, with the same quantity, will run from eighteen to twenty days.

Int. 10. Independent of the wearing qualities of the respective oils, how did they compare as to lubricating qualities for use in your machinery?

Ans. I don't know how that I can answer that.

Int. 11. I mean as to the ease with which the machinery turns upon its bearings.

Ans. I don't know now how that I can give you a satisfactory answer. I think this oil is a perfect lubricator; the other oils that I have used, in a very short time the journals would run dry. The best way that I can compare it would be as to its wearing qualities.

Int. 12. Beside Coffin's and the Downer oil, have you tried other paraffine oils on your machinery?

Ans. I have; small quantities.

Int. 13. While using the oil such as you now use, have you had any difficulty from the heating of your bearings?

Ans. I have not.

Int. 14. How was it while using Coffin's and the other paraffine oils?

Ans. I had some difficulty. The bearings would cut once in a while.

Cross-examination by Causten Browne, esq., in behalf of the defendant.

Cross-int. 1. Did you buy Coffin's oil in the year 1869 only?

Ans. I think that was the only time.

Cross-int 2. How much in all did you have of it?

Ans. Perhaps forty or fifty gallons.

490 Cross-int. 3. From whom did you buy it?

Ans. From Mr. Coffin.

Cross-int. 4. You do not know, do you, what it was in the Coffin oil that caused the odor you speak of and caused it not to wear as long as you thought it ought to?

Ans. I do not.

Cross-int. 5. What other oils have you experimented a little with?

Ans. I have had one or two small lots of Mr. Marshall, in Broad street, and of a Mr. Walker, I think, in Clinton street.

Cross-int. 6. You have spoken of noticing a change in the Downer oil within three or four years. Has the Downer oil which you have bought within that time been sold to you under any name other than that which their oil had previously been sold to you under?

Ans. I think about the time I noticed a change they made a change in the price. The bills were always made in one way, under the same heading, except once where it was marked "extra."

Cross-int. 7. What was the change in the price you speak of?

Ans. I had been paying seventy-five cents a gallon. There was one lot that was billed at a dollar a gallon.

Cross int. 8. I mean to inquire what that change of price was which you say you noticed about the time when you say you noticed a change in the character of the oil?

Ans. It was twenty-five cents on a gallon.

Cross-int. 9. Do you mean that since about the time you noticed that change in the oil you have paid twenty-five cents on the gallon right along more than you paid before?

Ans. I do not. I don't remember but one bill which was twenty-five cents more.

Cross-int. 10. Leaving out that bill, then, what prices have you paid for the Downer oil within the last three or four years? And if they have differed from what you paid previously, please state that also.

Ans. For Downer's oil I have paid seventy-five cents a gallon. I don't remember what I paid for it when I first began to use it; I think it was about sixty cents.

Cross-int. 11. Has the price you have paid within the last four years differed from seventy-five cents a gallon?

Ans. I don't remember when the change was made.

491 Cross-int. 12. Did the price go right up from sixty to seventy-five cents or rise gradually?

Ans. I think it went right up.

Cross-int. 13. Will you refer to your books and note the various prices you have paid for the Downer Company's lubricating oil since you have bought it of them and the dates at which any change or changes in the price have occurred?

Ans. I will. I have bought the oil ten gallons at a time.

Cross-int. 14. Did you use the Coffin oil pure or mixed; and, if mixed, what with?

Ans. I used it pure.

Cross-int. 15. What do you mean by the heating of your bearings, and what makes them heat?

Ans. There are a number of things to cause a bearing to heat. If the bearings are not in a line, or if the e is not sufficient oil upon them, or if a bit of gravel got into them, they would heat.

Cross-int. 16. While you were using the Coffin oil did the bearings heat except when the oil was about run off and the time had come to lubricate again?

Ans. No.

Cross-int. 17. Don't they heat now when the oil has about run off and the time has come to lubricate again?

Ans. I don't have any trouble now; we usually intend to oil up the machines about so often, and with the Coffin oil I had to use it too often. Our rule is, on a planing machine, to oil up every morning the first thing that they do; and we oil the cylinders and side cutters about once in an hour, and with a light oil that isn't sufficient.

Cross-int. 18. With either oil, if you go too long without lubricating, the journals will heat for want of oil, won't they?

Ans. Yes, sir.

Cross-int. 10. So that it is really a question of the frequency with which you must lubricate in the case of one oil or the other, isn't it?

Ans. Yes, sir.

Cross-int. 20. What do you mean by the bearings "cutting."

Ans. When the bearings begin to heat the metal expands, and the surfaces grind together, when the oil runs short.

492 Cross-int. 21. Do you remember what prices you paid for the Coffin oil? State them.

Ans. Yes, sir. Sixty cents a gallon.

Cross-int. 22 I find I shall have to get you to give us the date, number of gallons, and price per gallon of each purchase of the Coffin oil. Will you please do so?

Ans. I have it already in a bill receipted by Mr. Coffin, which I produce as an exhibit in the case, to be marked "Exhibit No. 93."

Cross-int. 23. Will you bring or send to J. R. Bartlett, oil-dealer in State street, C. O. D., a gallon of your last purchase of Merrill's deodorized heavy hydrocarbon oil, bought of Downer?

Ans. I will.

SAM'L H. L. PIERCE.

Exhibit No. 93.—H. Farnam Smith, special examiner.

BOSTON, *July*, 1869.

Mr. S. H. L. Pierce to C. F. Coffin.

June	2.	10 gals. mac. oil, a 60c.	$6 00
	14.	10 " " "	6 00

	25.	9	"	"	"	5 40
May	7.	10	"	"	"	6 00
						$23 40

Received payment,

CHAS. F. COFFIN.

Deposition of Thomas S. Shaw, taken before H. Farnam Smith, special examiner, Wednesday, January 24, 1872.

Direct examination by Walter Curtis, esq., in behalf of the plaintiff.

Int. 1. What is your name, age, residence, and occupation?

Ans. Thomas S. Shaw; fifty years of age: residence, Lowell, Mass. I am a manufacturer; agent for the Tremont and Suffolk Mills.

493 Int. 2. How long have you been agent for those mills?

Ans. I have been three years on the Suffolk, and since the consolidation I have been agent for both. I have had the Tremont agency for a little over a year, but the consolidation took place last July.

Int. 3. What kind of goods do those mills produce?

Ans. Sheetings, shirtings, and cotton flannels, drills and corset jeans.

Int. 4. How many spindles do those mills run?

Ans. Eighty-four thousand.

Int. 5. While you have been agent for those mills, what kind of oil have you used for lubricating purposes?

Ans. I have used sperm and Seccomb's spindle oil and Downer's spindle oil, and I have used another kind, but do not recollect its name.

Int. 6. What oil are you now using at those mills?

Ans. Sperm and Downer's spindle oil.

Int. 7. Whether you purchase the oils which you use at your mills pure, and mix them yourself, or buy them in a mixed state?

Ans. I buy them pure, and mix them myself.

Int. 8. Whether or not the oil you now use is that patented by Mr. Merrill, of the Downer Kerosene Company, or sold as such?

Ans. It is sold to me as such.

Int. 9. Prior to using Merrill's oil, have you purchased oils of Yeomans & Goss, or of D. M. Yeomans, of Boston?

Ans. That is a name I have lost; but I am very sure I have bought oil of that name. I have either bought of them there or else I have used it at other places. I have had some experience with that oil. I think it was two years ago I used some of Yeoman's oil.

Examination suspended by consent.

SATURDAY, *January* 27.

Int. 10. Since testifying on Wednesday last, have you examined your books to ascertain what lubricating oils other than Merrill's patent oil you have used at the Tremont and Suffolk Mills? If so, state what the result of your investigation has been.

Ans. I have. I find I have used Marshall's and Seccomb's oils. I have not used a great deal of either kind, for this reason: I tried some of Seccomb's oil, and I thought it did not give as good satisfaction in the mill as that I had been using, and for a number of reasons.

494 The first was, there was more odor to it than to the Downer's, and then I thought it gummed my rollers and bearings more. My roller became dry very quick on using it. The Marshall oil was partially prepared in two different shapes. They had what they called oil

for heavy and oil for light bearings. That gave me considerable trouble, in gumming on the bearings and becoming dry very quick. I didn't use those oils very extensively, for the reason that I was so well satisfied with the Downer oil, it being uniform, and always apparently about the same thing, and without that odor—so much of it as I find in other oils.

Int. 11. State in what proportions you mix the Merrill patent oil and sperm oil for your use.

Ans. I have used the Merrill oil clear; I have used it half and half and three to one.

Int. 12. How do you now use it?

Ans. I am using it about three to one.

Int. 13. State what satisfaction the Merrill oil has given when compounded, as above stated, with sperm, as to durability, odor, and with reference to the staining of goods.

Ans. The satisfaction has been good. In mixing it half and half, I did so for fear of any bad result that might come from mixing it any weaker. I found that it was safe then, and then I mixed it three to one, and that was satisfactory. I couldn't see but that it lasted as long as it did half and half, and then I tried it clear. I thought it didn't work quite so well as it did to have it about three to one. I thus far answered with respect to durability. As to odor, I shouldn't know that it was in the mill, and this whether it was pure or mixed. I have had no complaint from the bleachery, and seen nothing of its staining.

Int. 14. Whether or not, prior to using the Seccomb and the Marshall oil, as you have testified, you had used Merrill's patent oil?

Ans. I had.

Int. 15. About what quantity, per month, of Merrill's oil do you use in your mills and of whom do you purchase it?

Ans. I think I use about five hundred gallons per month, and purchase it of C. B. Coburn, of Lowell.

Cross-examination waived.

THOMAS S. SHAW.

495 *Deposition of Charles O. Shove, taken before H. Farnam Smith, special examiner, Thursday, January 25, 1872.*

Direct examination by Chauncey Smith, esq., in behalf of the plaintiff:

Int. 1. What is your name, age, residence, and occupation?

Ans. Charles O. Shove; 47; Fall River, Mass.; treasurer and agent of the Granite Mills.

Int. 2. What lines of goods are manufactured at these mills?

Ans. Printing cloths only; cottons.

Int. 3. How many operatives have you and how many spindles do you run?

Ans. About four hundred operatives. We run about thirty-six thousand spindles.

Int. 4. Do you use paraffine lubricating oil in your mill? If so, for what purposes, and what oil?

Ans. We use Downer's deodorized oil for lubricating purposes. We use it on all our machinery but our engines.

Int. 5. How long have you used Downer's deodorized oil?

Ans. I can't say positively, but I should say about a year.

Int. 6. Before you used that oil did you use any paraffine oils for lubricating, manufactured by other parties? If so, state what kinds of

oil they were, or by what name they were known, and of whom you procured them.

Ans. I used almost every article that was made, and bought them of their recognized agents. I have used the Portland oil, Maysville oil, oil manufactured by Seccomb, Kehew & Thayer, that sold by Smith & Merrill, and oils of a great many other parties, whose names I cannot now recall.

Int. 7. State whether or not you ever purchased oils of the defendants, Yeomans & Goss; and, if so, what names such oil bore.

Ans. I think they called the oil I bought of them deodorized neutral oil.

Int. 8. Have you ever purchased paraffine oils of the Metropoli-
496 tan Oil Company of New York? If so, state if you know of whose manufacture such oils were.

Ans. I have bought of them, and they claimed them to be of their own manufacture.

Int. 9. State, as nearly as you can, during what period you purchased and used the oils of the various parties mentioned above.

Ans. I can't state any special time for each one; previous to the last year, I used them promiscuously during four or five years.

Int. 10. State whether or not you used them for the same kind of machinery as that on which you used the Downer's deodorized oil during the past year.

Ans. Precisely the same. I ought to state that I used none of them clear. My custom has been to use one part of sperm or tallow oil to three parts of the paraffine oils, mixing them myself.

Int. 12. State whether or not you have mixed the Downer oil in the same manner since you used that.

Ans. I follow the same rule.

Int. 13. State whether you found any objections to the use of the Maysville oil, the oil manufactured by Seccomb, Kehew & Thayer, and the Portland Oil Company, that which you purchased of the defendants, and that which you purchased of the Metropolitan Company? If so, you will state generally what such objections were, and how far they appertained to each one of the oils mentioned.

Ans. The result of the use of most of these oils was unsatisfactory, varying, as the quality of the oils varied, from the cheaper oils to the deodorized. The objections were principally the offensive odor in the mill, the discoloration of the machinery and windows, and, in some cases, hot bearings.

Int. 14. State whether or not you experienced from any of these oils a staining or discoloration of the goods manufactured.

Ans. Yes, sir.

Int. 15. Which of the oils referred to did you find to be most free from these objections?

Ans. I think all paraffine oils will stain more or less, varying in degree, by reason of the purity of the oil and the color as well as the amount of naphtha left in the oil. Whatever oils I bought from the sellers as deodorized oils stained less than the common paraffine
497 oils. I found this so general that I finally abandoned the use of the common paraffine oils entirely.

Int. 16. Did you find any difference as to the odor and the staining of the windows and the heating of the machinery, between the Maysville oil, the Portland oil, the Seccomb, Kehew & Thayer oil, Yeomans & Goss oil, and that procured of the Metropolitan Oil Company?

Ans. It would be difficult to discriminate between the several kinds of oil. I found them all more or less objectionable and unsatisfactory.

Int. 17. State whether or not you have found these objections to exist in respect to Downer's deodorized oil, which you have used during the past year.

Ans. I have had no complaint whatever, and have seen no objection, and it is that which has led me to adopt the use of it entirely, in place of other paraffine oils.

Int. 18. What have you found its character to be in respect to staining the goods?

Ans. I have had no complaint from staining the goods since I have used it. Of course I cannot tell whether this is on account of our care or of the quality of the oil.

Int. 19. How does it compare with the paraffine oils you previously used, in respect to body and its lubricating properties?

Ans. I found its quality to be uniform, so that I could always depend upon it, and I have had no complaints of hot bearings since. It is a heavier-bodied oil. Almost every selling agent makes Downer's oil the standard. If he can make out his oil to be nearly as good, or quite, he thinks he is doing well.

Cross-examination by Causten Browne, esq., of counsel for respondents.

Cross-int. 1. Will you send by express to John R. Bartlett, 127 State street, Boston, C. O. D., a gallon can of oil taken from the Downer deodorized oil, which you are now using, as you have testified? I mean unmixed, as you buy it.

Ans. Yes, sir.

Cross-int. 2. When you took the Seccomb, Kehew & Thayer oil, and the Yeomans & Goss oil, did you take bills of them?

Ans. I did.

498 Cross-int. 3. Will you send them, together with the can of Downer oil, to Mr. Bartlett?

Ans. I couldn't undertake to do that. It is too much trouble.

Cross-int. 4. Apart from the bills, can you tell with certainty, either the dates of the sales or the name or brands under which the oil was sold?

Ans. I could not, without referring to my books.

Cross-int. 5. Will you do so, or is that too much trouble?

Ans. No, I should not undertake it. If you will go down to Fall River, I will show you the books.

Cross-int. 6. Can you give the name of the selling agent or manager of the Metropolitan Oil Company?

Ans. I do not recollect it.

Cross-int. 7. The superintendent of your mill has the actual charge of the rooms in which the lubricating oil is used, has he not?

Ans. I have had no superintendent for four or five years, till within a year. The oil has been mixed and used under my personal direction the whole of the last four or five years.

Cross-int. 8. Who is the superintendent you have had during the last year?

Ans. James McCreary.

Cross-int. 9. During the preceding three or four years, did you perform all the duties of superintendent as well as those of treasurer and agent?

Ans. Yes, sir.

Cross-int. 10. During this time you had overseers, I suppose, who had

immediate charge of the rooms in which the oil was used, and who reported to you from time to time?

Ans. Yes, sir.

Cross-int. 11. Did you have any who are not now in the employment of your company?

Ans. I have changed one, I believe, who has grown into a superintendent somewhere else since. His name is Eliphalet Emery, and he is superintendent of the Mechanics' Mills at Fall River.

Cross-int. 12. You say, "whatever oils I have brought from the sellers as deodorized oils stained [goods] less than the common paraffine oils." Which oils do you here refer to as called deodorized oils by the sellers?

499 Ans. Yeomans & Goss sold an oil they called "deodorized." Smith & Merrill and I might add that almost every oil-seller pretends to have it now amongst the goods that he offers for sale.

Cross-int. 13. I asked you nothing about what sellers pretended now-a-days; I asked you which of the oils that you bought before you began buying the Downer paraffine oil that you now use were "bought from the sellers as deodorized oils." You have mentioned in answer to my question an oil of Yeomans & Goss and an oil of Smith & Merrill's. Were those all?

Ans. My impression, not. I don't pretend to carry in my mind all the oil-dealers that I bought of, or the oil I bought of them. I only speak of them as they came into my mind.

Cross-int. 14. Have you used, in all respects, the same means of bleaching during the last five years?

Ans. We don't bleach at all.

Cross-int. 15. Do you have your goods bleached or do you sell them unbleached?

Ans. We sell them unbleached.

Cross-int. 16. You do not profess to know, I think, what causes the staining of the goods?

Ans. I do not.

Cross-int. 17. Are your unbleached goods sold to consumers, or to dealers who sell to consumers?

Ans. I sell them to calico-printers, who are neither consumers nor dealers. I have sold three-quarters of my goods during the last year to one party, and largely to that party before that—to David S. Brown & Co., of Philadelphia. The calico-printers bleach their goods before they print them.

Cross-int. 18. Do you use sperm oil on any of the bearings of your mill, and on what bearings?

Ans. I use sperm oil alone, on a few heavy bearings.

Cross-int. 19. When you speak of the Downer paraffine oil you are now using, as a heavier-bodied oil, do you mean that it lasts longer on the bearing—doesn't have to be renewed so often?

Ans. Yes; that is the result of a "heavy body."

CHAS. O. SHOVE.

500 *Deposition of Horatio N. Durfee, taken before H. Farnam Smith, special examiner, Saturday, January* 27, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the plaintiff.

Int. 1. What is your name, age, residence, and occupation?

Ans. Horatio N. Durfee; thirty-four years of age; residence, Fall River, Mass.; acting agent and treasurer of the Mechanics' Mills.

Int. 2. How long have you been connected with the Mechanics' M ls and if you have been engaged in manufacturing prior to your connection with the Mechanics' Mills, state in what way.

Ans. Since the ninth of January, 1871. For the two years prior to that time in the Troy Cotton and Wool Manufactory, and for six years prior to that as a manufacturer of agricultural implements.

Int. 3. What number of spindles run in the Mechanics' Mills and what number in the Troy?

Ans. In the Mechanics', 53,712; and the Troy has about 40,000.

Int. 4. State what, if anything, you have had to do with the selection of the lubricating oils used in those two mills.

Ans. I have been consulted in the matter of the best oils for lubricating purposes, and have favored the Downer kerosene spindle oil.

Int. 5. How long has that oil been in use at either of those two mills?

Ans. Since the construction of the Mechanics' Mill, and during the period of my connection with the Troy Mill, and how much earlier I cannot say.

Int. 6. State whether it has been used pure or mixed. If mixed, in what proportions, and what satisfaction it has given as to durability, economy, and in reference to the staining of the goods.

Ans. Until within the last sixty days we have used it mixed with sperm oil, in the proportions of two gallons sperm to eight gallons spindle. For the last sixty days we have used it pure or unmixed. We have always been entirely satisfied in the matter of its durability and economy. Any accidental stains we find to be easily removed by the use of soap and water.

501 Int. 7. Is the machinery driven at the Mechanics' Mills by steam or water?

Ans. By steam.

Int. 8. What difference, if any, do you find in the consumption of fuel since you have used this oil unmixed, as compared with that used when mixing it with sperm?

Ans. I have noticed none.

Int. 9. State what led you to make use of this oil unmixed instead of continuing to use it mixed with sperm.

Ans. The rapid advance in the price of sperm oil.

Int. 10. Have you any complaints made in regard to the odor of the oil that you are now using?

Ans. I never heard any.

Int. 11. Prior to being connected with the two mills mentioned, have you ever been engaged in any way in the business of dealing in oils?

Ans. I was. When I first went into an office it was that of J. B. Wood & Co., of New Bedford, who were agents for eleven whale-ships, and there I acquired some knowledge of whale, sperm, and other fish oils. From there I became book-keeper and salesman in the house of Burgess & Smith, of New Bedford, at their branch house in Albany, New York, who were also oil-dealers.

Int. 12. About what quantity of the Downer oil you are now using do you purchase per month, and from whom do you buy it?

Ans. We buy about three hundred gallons per month, and buy it of the Downer Kerosene Oil Company, Boston.

HORATIO N. DURFEE.

502 *Deposition of Hermann Keller, taken before H. Farnam Smith, special examiner.*

Direct examination by Chauncey Smith, esq., in behalf of the plaintiff.

Int. 1. State your name, age, residence, and occupation.

Ans. Hermann Keller; age, forty-one; residence, Pittsburg. I am a mechanic in iron work.

Int. 2. Do you know Dr. Tweddle, of Pittsburg, and did you ever work for him?

Ans. I do. I have.

Int. 3. When and where did you work for him?

Ans. I worked for him two years at the Standard Oil Works. That was, I believe, in 1864, the time the war was finished. I worked afterwards at the Eclipse Refinery, near Thorpsburg bridge. I was there about a half year. I can't tell exactly what year.

Int. 4. State whether it was about the time that Dr. Tweddle commenced building the works that you commenced working for him.

Ans. Yes, sir.

Int. 5. After you had worked for him about six months did you work for him again at the Eclipse Works?

Ans. Yes, sir.

Int. 6. How long between?

Ans. I think three or four months. I couldn't tell exactly; didn't turn my attention to it.

Int. 7. How long did you work there this time?

Ans. I think about a year or so; couldn't tell exactly.

Int. 8. State whether you staid till the works were burned.

Ans. Yes, sir.

Int. 9. What work did you do for Dr. Tweddle at the Eclipse Refinery?

Ans. Mechanic work; gas-fitting.

Int. 10. Do you recollect the first still which Tweddle put up at the Eclipse Works? If so, what kind of still was it?

503 Ans. I do. It was a cast-iron still.

Int. 11. If you did any work on it, tell what kind of work it was.

Ans. The finishing up. I put pipes in and set it in the place there.

Int. 12. Did Dr. Tweddle build two more stills after that? And, if so, what kind of stills were they?

Ans. Yes, sir. They were wrought-iron stills.

Int. 13. Did you do any work on these stills? And, if so, what kind of work?

Ans. Yes, sir; bored out some boxes and screwed the pipes in.

Int. 14. When these two stills were used, were they used both together?

Ans. Yes, sir.

Int. 15. When they were first put up, how was the heat applied to distil the oil?

Ans. In them two?

Int. 16. Yes; in those two how was the heat applied?

Ans. It didn't work, not very well, the first time. He tried another experiment with benzine fire. After that, works better.

Int. 17. Before they had the benzine fire how did you heat them?

Ans. There was not enough pressure to heat the oil. Before they had the benzine, they heated with steam. He got steam on and it didn't work; then he tried with benzine fire too.

Int. 18. How did they put the benzine fire to the still?

Ans. From the tanks by pipes, under the stills.

Int. 19. After they used the benzine fire how did the stills work?

Ans. It worked very well after that.

Int. 20. Did they use the benzine fires all the time after they put the pipes under the stills?

Ans. Yes, sir.

Int. 21. Did they use steam too, when they used the benzine fires?

Ans. Yes, sir.

Int. 22. How did the benzine pipes come from the tank into the still?

Ans. They laid under the ground, so that nobody can see it.

Int. 23. While you worked for the doctor, did you go up to Aladdin to do some work on a still for Mr. Brereton?

504 Ans. Yes, sir.

Int. 24. What work did you do up there?

Ans. I laid the benzine pipes below the tanks to the stills.

Int. 25. Were those stills like the two wrought-iron stills Dr. Tweddle had at the Eclipse Works?

Ans. Yes, sir.

Int. 26. Did Dr. Tweddle build another still at the Eclipse Works before the fire?

Ans. Yes, sir.

Int. 27. Did you do any work on that still?

Ans. Yes, sir.

Int. 28. What kind of work?

Ans. I laid pipes inside, for heating up the oil.

Int. 29. Were there any pipes for making a benzine fire under that still?

Ans. Yes, sir; I put it under.

Int. 30. Were there any benzine pipes under the first still, the cast-iron still?

Ans. No, sir.

Int. 31. How much did Dr. Tweddle use the the cast-iron still?

Ans. He couldn't use it at all; couldn't make any oil in there; couldn't get enough heat in it.

Adjourned to 2.30 p. m.

Feb. 23, 2.30 p. m., adjourned to 24th, at 10 a. m.

Cross-examination by Wm. Bakewell, esq., of counsel for respondents.

Cross-int. 1. You say that you were in the employ of Dr. Tweddle, when he put up his first cast-iron still, at his Eclipse Works near Sharpsburg bridge. How long was it before the other iron stills of which you have spoken were put into operation?

Ans. Several months; I don't know how long; I didn't take no notice.

Cross-int. 2. How long were you there after the commencement of the Eclipse Works before you left his employ? State as nearly as you can.

505 Ans. I couldn't tell how long the time; I worked there several months.

Cross-int. 3. Did you leave before or after the two wrought-iron stills were put up?

Ans. After. I left Dr. Tweddle after the cast-iron still was put up,

and came back again when the wrought-iron still was finished from the boiler-maker.

Cross-int. 4. When you came back to Dr. Tweddle at the Eclipse Works, was that the time the two wrought-iron stills were finished making, and before they were set up? Do I understand you aright?

Ans. Yes, sir.

Cross-int. 5. Before those two wrought-iron stills were put up, Dr. Tweddle had no other stills but the cast-iron still at the Eclipse Works, had he?

Ans. Only that one.

Cross-int. 6. How much oil did Dr. Tweddle distil at the Eclipse Works during the time you were there prior to your first leaving?

Ans. I couldn't tell. I didn't took not much attention to it.

Cross-int. 7. Why did you not give much attention to it?

Ans. I has to do my work, but it didn't belong to me, the oil business.

Cross-int. 8. Your business there was not around the still, excepting when it was in need of repairs, was it?

Ans. Excepting I was sometimes an hour or half an hour on it. I am no stillsman. My business was mechanic and gas-fitting.

Cross-int. 9. Do you know what was done with the oil distilled from that cast-iron still? Where was it put?

Ans. He couldn't use it, what I know, so long as I was there. He used some for the other purposes.

Cross-int. 10. What did he do with the oil he heated up in it?

Ans. He run it into the other oil in the tanks outside.

Cross-int. 11. What did he run it through, from the cast-iron still into the tank you speak of?

Ans. Through a gas-pipe.

Cross-int. 12. What was that gas-pipe connected with?

Ans. From the still in through to the tank.

506 Cross-int. 13. Was this done all the while that you were there, before you left the first rime?

Ans. It was done the second time I was there.

Cross-int. 14. Were there any condensers connected with that cast-iron still?

Ans. Yes, sir.

Cross-int. 15. Did the oil run from the still through them at all?

Ans. I didn't see it did at all.

Cross-int. 16. Did the superheaters connected with that still often give out or burst?

Ans. Yes, they did?

Cross-int. 17. Did you not have to take those superheaters down and break them up and put up a new set?

Ans. Yes, sir.

Cross-int. 18. Did you not do that more than once?

Ans. Sometimes it was burst and we repaired them.

Cross-int. 19. How was the pipe fixed through which the oil ran from the cast-iron still into the tank you speak of?

Ans. It was filled below in the still to run into the tank.

Cross-int. 20. Below what?

Ans. Below the still.

Cross-int. 21. How was the oil run into the cast-iron still?

Ans. He took it from the other stills, Nos. two and three, and run into No. one, the cast-iron still.

Cross int. 22. By stills two and three you mean the wrought-iron stills, do you not?

Ans. Yes, sir.

Cross-int. 23. Then I understand you that in using the two wrought-iron stills, the cast-iron still was used for first heating up the oil. Is this right?

Ans. Yes; the cast-iron still was used in heating it up. That's all that I know.

Cross-int. 24. Now, before the wrought-iron stills were put up, and while you were first at the Eclipse Works, for what purpose was the cast-iron still used?

Ans. Well, he wants to make oil in it, but I see he couldn't use it, what I know.

507 Cross-int. 25. How many months were you there the first time? State as nearly as you can.

Ans. It might be five or six months; it might be longer. I don't take any attention to it.

Cross-int. 26. During that time what was done with the oil which was put into the cast-iron still?

Ans. Well, he put in the tank the oil, and put in barrels and sent 'em away some place.

Cross-int. 27. During the first five or six months did Dr. Tweddle give you some green lubricating oil to try on the fan and also on the gas-pipe machine?

Ans. Yes, sir.

Cross-int. 28. How did it work?

Ans. It worked pretty well for what I could see.

Cross-int. 29. Did he also give you some yellow lubricating oil during those first five or six months to try on the fan and on the gas-pipe machine?

Ans. Yes, sir; he gave me a good many different kinds.

Cross-int. 30. How did that work?

Ans. Oh, one was better than the other sometimes. I couldn't tell what different oils they were. I took no attention to what the name of it was.

Cross-int. 31. When did you first put the pipe from the benzine tank under the two wrought-iron stills?

Ans. I couldn't tell the time. It was that time they experimented on it and couldn't do it without.

Cross-int. 32. How long was it after the two wrought-iron stills were put up?

Ans. I couldn't tell.

Cross-int. 33. Did you not also lay a benzine pipe from the benzine tank to the furnace under the steam boilers?

Ans. Yes, sir.

Cross-int. 34. What was the diameter of the benzine pipe that you laid to the stills?

Ans. Three-fourth inch.

Cross-int. 35. And what to the boilers?

Ans. The same—all in one line.

508 Cross-int 36. When this pipe left the benzine tank did it not go right under-ground, and was it not carried from there all the way under-ground until you came to the stills and boilers?

Ans. Yes, sir.

Cross-int. 37. Was it not laid under-ground to prevent accident to the pipe and to prevent the escape of benzine?

Ans. Yes, sir.

Cross-int. 38. Was not the pipe laid under a wagon-road part of the way?

Ans. Yes; part of it.

Cross-int. 39. The pipe was iron gas-pipe, was it not?

Ans. Yes, sir.

Cross-int. 40. How do you know that the pipe under the stills was used all the while for burning benzine? Might it not sometimes have been not used without your knowing it?

Ans. Yes. Sometimes they don't still any and don't use any.

Cross-int. 41. How do you know but that the stills were sometimes used without burning benzine under them?

Ans. Well, I was a good many times in that still-house.

Cross-int. 42. When you were in the still-house did you always look to see whether the benzine was burning under the stills?

Ans. Yes. I didn't look so sharp till I see a good many times that they couldn't do it without.

Cross-int. 43. But there were some times when they could use it without, were there not?

A. Yes.

Cross-int. 44. Did you put glass windows, set in brass castings, to look into the cast-iron still?

Ans. Yes, sir.

Cross-int. 45. Was that not during the first five or six months that you were at the Eclipse Works?

Ans. Yes, sir.

Cross-int. 46. Did you not put glass doors to the window-frames which you put in that still?

Ans. Yes, sir.

Cross-int. 47. Do you not recollect, during the first five or six months that you were at the Eclipse Works, looking in through these windows and seeing the oil boiling in that cast-iron still?

509 Ans. I looked in; I couldn't see anything.

Cross-int. 48. Were there not two windows set on opposite sides of the still, so as to throw light in when both windows were open?

Ans. Yes, sir.

Cross-int. 49. When you looked in at one of these windows, and both doors were open, what did you see?

Ans. I couldn't see anything that was in it.

Cross-int. 50. What did it look like inside?

Ans. A good many pipes; and black, it looked inside.

Adjourned to 3 p. m. 3 p. m. resumed.

Cross-int. 51. In the cast-iron still and the two wrought-iron stills you have spoken of as used at the Eclipse Works, was the steam superheated in a cast-iron coil of pipe in a heating furnace?

Ans. Yes, sir.

Cross-int. 52. How hot did these cast-iron pipes get?

Ans. They sometimes got red hot.

Cross-int. 53. Do you know what is meant by steam leaking through iron?

Ans. Yes, sir.

Cross-int. 54. Did the steam, after these cast-iron superheating pipes had been some time in use, leak through the pipes?

Ans. Yes, sir.

Cross-int. 55. When that happened in the cast-iron still, did Dr. Tweddle use the benzine flame underneath the still?

Ans. No, sir.

Cross-int. 56. Did he, when it happened in the wrought iron stills?

Ans. Yes, sir.

Cross-int. 57. When the steam began to leak through the cast-iron coiled pipe, did the doctor have those superheating pipes taken out and new ones put in?

Ans. Yes, sir.

Cross-int. 58. How long did it take to get the new ones, and get them in?

Ans. They was different sometimes, how long it took.

510 Cross-int. 59. Was it sometimes weeks and sometimes months, before he got the new superheating pipes put in?

Ans. Not months; sometimes a week or two, or so.

Cross-int. 60. If I understand you, it happened quite a number of times at the cast-iron superheating pipes got to leaking steam, and had to replaced by new ones. Is that so?

Ans. Yes, sir.

Cross-int. 61. Did the same thing ever happen to the superheating pipes at the Standard Works?

Ans. Yes, sir.

Cross-int. 62. Do you know of any serious accident or trouble that ever occurred at the Eclipse Works, except this leakage of steam through the superheating pipes?

Ans. That's all; the steam leaking; and it was fixed again.

Cross-int. 63. Do you know what a vacuum is?

Ans. Yes, sir.

Cross-int. 64. And what a vacuum apparatus is?

Ans. Yes, sir.

Cross-int. 65. What is it?

Ans. You can see how much pressure you get on.

Cross-int. 66. Who asked you to come here to testify?

Ans. I got some business.

Cross-int. 67. What business.

Ans. I was in New York and see mine brother and crossed here.

Cross-int. 68. What did you cross here for? Did you have any other business here?

Ans. Yes, sir.

Cross-int. 69. What was that?

Ans. I guess I can travel over the whole United States.

Cross-int. 70. What business did you have here except to testify in this case?

Ans. Well, I travelled over about this case.

Cross-int. 71. Who asked you to come here about this case?

Ans. Some gentlemen here in this room asked me.

Cross-int. 72. Which one?

Ans. Mr. Abbott and Mr. Merrill.

511 Cross-int. 73. Did they see you together, or at seperate times?

Ans. At separate times.

Cross-int. 74. Which saw you first?

Ans. Mr. Abbott.

Cross-int. 75. How long was that before Mr. Merrill saw you?

Ans. A few days.

Cross-int. 76. How long ago did you see Mr. Abbott on this subject for the first time?

Ans. About a half year ago.

Cross-int. 77. At Pittsburg?

Ans. Yes, sir.
Cross-int. 78. Whereabouts in Pittsburg?
Ans. A little out in the country, at the place where I was working.
Cross-int. 79. Are you employed there still?
Ans. No, not now.
Cross-int. 80. Where are you employed now?
Ans. Well, I work in town, some place. Pittsburg.
Cross-int. 81. What place in Pittsburg?
Ans. I was working down at the City Hall.
Cross-int. 82. You've seen Mr. Abbott more than once about this case, haven't you?
Ans. Yes, sir.
Cross-int. 83. How many times?
Ans. I couldn't tell; I guess five or six times.
Cross-int. 84. When was the last time you saw him before you came here?
Ans. Saturday last.
Cross-int. 85. Have you any paper in your possession singed by Mr. Abbott?
Ans. No, sir.
Cross-int. 86. Has any agreement been made to pay you anything for coming here to testify?
Ans. Yes, sir.
Cross-int. 87. Who made it?
Ans. Mr. Abbott.
Cross-int. 88. What is it that you are to be paid?
Ans. He paid me some money.
512 Cross-int. 89. What is it that is to be paid? How much?
Ans. I couldn't tell exactly.
Cross-int. 90. How much has he paid you already?
Ans. About thirty dollars.
Cross-int. 91. Now state how much more it is agreed that you shall have.
Ans. It is no use telling everything of this article here, I think.
Cross-int. 92. You object to answering, do you?
Ans. I guess that's all what I can tell now.
Cross-int. 93. You object to saying anything more now, do you?
Ans. It might be; I don't know.
Cross-int. 94. Will you, or will you not, say how much more it is agreed that you shall receive besides the thirty dollars already paid?
Ans. No, sir.

HERMANN KELLER.

Deposition of Byron M. Peck, taken before H. Farnam Smith, special examiner, February 23, 1872.

Direct examination by Chauncey Smith, esq., of counsel for complainant:

Int. 1. State your name, age, residence, and occupation.
Ans. Byron M. Peck; age, 28; residence, Warren, Ohio; occupation, seller of oil by sample. My business is generally travelling as oil-seller.
Int. 2. State how long you have been engaged in the sale of oils, and what kind of oils.
Ans. I commenced in November, 1865, and have been engaged in no other pursuit. I have sold lubricating oils—petroleum lubricating oils, exclusively.

Int 3. State in what part of the country you have sold oils.

Ans. Throughout the entire Northwest; west as far as Lawrence, Kansas; south, or southwest to New Orleans; east as far as Baltimore and Eastern Pennsylvania.

513 Int. 4. State whether or not you have sold among these oils what are known as paraffine lubricating oils.

Ans. I have.

Int. 5. Of whose manufacture have the lubricating oils that you have sold principally been?

Ans. Mason, Pease & Moore, of Pittsburgh; Moorhouse, Merriam & Co., of Cleveland, and their successors.

Int. 6. State where you resided in 1868 and 1869, and in what way you carried on the business of selling oils during that period?

Ans. Both in Cleveland and Pittsburgh. In the summer of 1868, I engaged with Moorhouse, Merriam & Co., of Cleveland; in November, 1868, I was associated with the firm of J. H. Pease & Co., of Pittsburgh. I was travelling as salesman for Moorhouse, Merriam & Co., and was a member of the firm of J. H. Pease & Co., of Pittsburgh. The latter engagement continued until the first of May, 1869. After that, on the first of June, I engaged with the firm of Moorhouse, Freeman & Crumb, the successors of Moorhouse, Freeman & Co., of Cleveland, and was with them during the rest of 1869.

Int. 7. When you commenced in November, 1868, with J. H. Pease & Co., if that firm had any paraffine lubricating oils which they sold, state what the character of such oils was, and of whose manufacture.

Ans. They had such oils. They were products of petroleum, called paraffine oil, manufactured by Moorhouse, Merriam & Co., of Cleveland. They were of a light straw color, very clear and transparent, and gravities from 23 deg. to 25 deg. Beaumé, and the most odoriess of any oils that I had any acqualntance with, and also freer of the blueish or greenish tinge.

Int. 8. State for what purposes these paraffine lubricating oils with which you were then acquainted were used, and in what way they were used.

Ans. They were used for compounding with animal oils of different classes or kinds.

Int. 9. State whether or not, at or about the time you became connected with the house of J. H. Pease & Co., you saw Dr. Herbert W. C. Tweddle, of Pittsburg; and, if so, state as nearly as you can, when and where you saw him, and how you came to see him?

514 Ans. I did see him at the office of Lockhart & Frew, where he had his office in December of 1868, or January of 1869. My attention was called to him by the firm of S. McLean & Son, bankers.

Int. 10. If that interview with him was in relation to business, state what the business was, and what passed between you.

Ans. I called for the purpose of getting the sale of his oils, or making purchases; more particularly desirous of getting the dark green oil for the trade of Eastern Pennsylvania. He had nothing upon which we ever agreed upon the prices that suited us, and after the green oils were dropped, he called my attention to a light, transparent oil, that he called spindle oil. He stated that he was selling it largely to the East, and it was giving good satisfaction for light rapid machinery. I was not willing to admit that it was much superior to the oils I was selling myself, of Cleveland manufacture, at much less prices than his.

Int. 11. State whether or not you had, after that, another interview

with Dr. Tweddle while you were with the firm of J. H. Pease & Co., and, if so, state when and where it took place, and what, if anything passed between you on such occasion?

Ans. I had another interview with him, I think in February, 1869, at the office of J. H. Pease & Co., of Pittsburg. He called for the purpose of purchasing five hundred barrels of the Cleveland paraffine oil, and wanted to know if I would agree to deliver that amount of oil at forty-five cents a gallon in Pittsburg. I could not do it, for the reason that the Cleveland folks were behind their orders, and it was uncertain when they could be able to ship any oil to Pittsburg again. Odors and qualities were discussed generally. I claimed that the Cleveland oils were, in my opinion, about equal to his, and preferable on account of the difference in price; that they were nearly if not quite as free from odor as the sample he had previously shown me. He stated there that that was not a fair sample of what he could or would shortly produce, in the way of odorless oils.

Int. 12. How did the Cleveland oil compare with Dr. Tweddle's oil, a sample of which you saw, as to gravity?

Ans. There was a difference of about seven degrees; the Clevelend oil, the sample we were discussing, being about twenty-five degrees, and he stating that his was about thirty-two degrees.

Int. 13. Did you at any time have another interview with Dr.
515 Tweddle? If so, state when and where it was, and how you came to have such interview with him?

Ans. It was about a year from the last February 9, 1870. I had learned of his having made improvements in his oils. The interview took place at Pittsburg, at the office of Lockhart, Frew & Co. I was then on a trip South selling. I called on him for the purpose of getting the sale of his oils, provided he had made the improvements that I had heard he had. I was selling on commission at the time, and my objeet was to increase my sales for the purpose of making more money. I stated to him what my object was, and what I had learned; and also that I had never seen any of his oils that I considered anything very superior. He stated that he had recently made improvements in his works and in his productions, and showed me a sample called "Neutral Topaz." It was superior to anything I had ever seen of his productions. He was willing that I should take samples, but after learning the route that I was going, didn't think I would have much chance of selling. He stated that this production was the best that was produced anywhere in the world. I took a sample with me, but never made any efforts, the points that I had reached having been previously canvassed by his agents.

Int. 14. If Dr. Tweddle at that interview said anything as to the nature of the improvement he had recently made in his oil, state what it was?

Ans. He did; that the improvements were in odor and in color more particularly; that they were neutral, as the name indicated, being really water-white and free from odor.

Int. 15. State whether anything was said by him, and if to, what, as to the freedom of those oils from the bluish or greenish tinge referred to previously by you. I mean the neutral topaz oil?

Ans. He did refer to the tinge or color, and said that he had succeded in removing that almost entirely or quite; that the neutral oil could be mixed with animal oils without showing that tinge—a feat that had never been previously accomplished by any one. I referred to the sample that I had seen about a year previous, as showing that tinge

very plainly. The doctor said that he had that time improved on that point as well as in color and odors, and that it would do all he had claimed for it in every particular.

Int. 16. At the previous interviews, had the doctor used the term "neutral topaz," as applied to any of his oils?

516 Ans. I don't remember that he did.

Int. 16. How did this neutral topaz oil he showed you at the last interview, as to its odor, compare with the oil of Moorhouse, Merriam & Co., as it was made the year previous, and at the time of the last interview by their successors, and with the samples of Dr. Tweddle's own oil which he had previously shown you?

Ans. It was very much superior in that respect, being almost entirely odorless. Either of the other productions were not nearly odorless.

Int. 17. What was the character of the odor produced by the other productions? I mean the oil of Moorhouse, Merriam & Co., and that shown you by Dr. Tweddle the year previous.

Ans. They had the odor of paraffine distillate, both of them.

Int. 18. State whether or not it was the same odor in kind with that belonging to other paraffine oils, of other manufacturers with which you were acquainted at the time.

Ans. It had; but I think not quite so strong an odor.

Int. 19. Have you, since that last interview, seen from time to time samples of Dr. Tweddle's neutral topaz-oil, and if so, will you state how such samples have compared with the sample shown you by Dr. Tweddle at the last interview?

Ans. I have seen samples. They, in some instances, have been an improvement on that sample—the last that I saw at his office. In other instances there seemed to be an improvement. There seemed to be some deviation.

Int. 20. At the time of the last interview, had you seen samples of "Merrill's deodorized oil," so called?

Ans. I had.

Int. 21. How did such samples compare with samples which Dr. Tweddle showed you of the neutral topaz oil?

Ans. They were freer from odor. That was the only difference I could discover. The doctor's oil, after being corked, would, when the cork was removed, emit a slight odor, which was perceptible.

Cross-examination by Wm. Bakewell, esq., of counsel for respondents.

Cross-int. 1. How long have you had any dealings in petroleum oils?

Ans. I commenced in 1865, in November, the sale of them.

517 Cross-int. 2. What business had you been in before that?

Ans. I had never been engaged in any commercial pursuits previous to that time.

Cross-int. 3. What is the names of the parties composing the firm of which you say you were a member?

Ans. J. H. Pease, T. W. Bishop and myself. The firm was J. H. Pease & Co.

Cross-int. 4. Was that the name of the Pittsburg firm of which you were a member?

Ans. It was.

Cross-int. 5. What do you mean by the term paraffine lubricating oils?

Ans. I understand them to be an oil obtained from paraffine distillate.

Cross-int. 6. Are all petroleum lubricating oils so obtained?

Ans. They are not.

Cross-int. 7. Why are they called paraffine oils?

Ans. Because they are obtained from the product left after the lighter oils are distilled off, according to my knowledge and understanding of it.

Cross-int. 8. Then I understand you that the term "paraffine lubricating oil," describes an oil manufactured from distillate of petroleum?

Ans. Yes, sir.

Cross-int. 9. Have you had much experience as a seller of such oils, in judging of their quality for lubricating purposes?

Ans. I have had considerable. I sold for two of the leading manufacturers of that class of oils?

Cross-int. 10. Do you refer to the oil of Pease & Moore, and of Moorhouse, Merriam & Co., referred to in your examination in chief? and state whether you have sold or dealt in paraffine lubricating oil made by any other manufacturers.

Ans. I do not refer to the paraffine oil of Mason, Pease & Moore, as one of the two firms; but to those of Moorhouse, Merriam & Co., and their successors. I have not sold paraffine lubricating oil of other manufacturers.

Cross-int. 11. What do you consider to be the distinguishing characteristics or characteristic of paraffine lubricating oil?

518 Ans. Freeness from odor; freeness from color, or blue or greenish tinge; and body enough to keep up the lubrication of very rapid machinery.

Cross-int. 12. How do you tell paraffine lubricating oil from other petroleum oils?

Ans. By their colors and odors.

Cross-int. 13. Describe, as accurately as you can, the difference in color and odor which distinguishes paraffine lubricating oil from other petroleum oils.

Ans. Paraffines are of a light amber, some of them nearly white, that I have seen, carrying the odor of the original distillate to some extent; other paraffines being nearly or quite free from them.

Cross-int. 14. I did not ask you at all in regard to paraffine, but in regard to paraffine oils.

Ans. I meant by paraffines paraffine oils. There are many other petroleum lubricating oils that have a very dark green color. Those are filtered West Virginia oils—petroleum—that retain the original odor and are of a cherry color, yet transparent.

Cross-int. 15. Those paraffine oils which you designate as filtered West Virginia oils, are not subjected to distillation, are they? I mean for the purpose of making labricating oils.

Ans. I do not designate any West Virginia oils as paraffine oils.

Cross-int. 16. Those West Virginia oils are not subjected to distillation for the purpose of making lubricating oils, are they?

Ans. I believe they are not.

Cross-int. 17. In your answer to cross-interrogatory 13, in distinguishing the difference in color and odor between paraffine lubricating oils and other petroleum oils, did you compare them with other distillates, or only with natural oils not subjected to distillation?

Ans. I compared them with petroleum lubricating oils, generally. Some of the dark lubricating oils are products of distillation, or left after distillation. Others are natural oils as they come from the earth, and the filtered West Virginia that I referred to in answer to cross-interrogatory 13.

Cross-int. 18. You state in your last answer that some of the dark lubricating oils are products of distillation, or left after distillation. Do you mean that some of them are distillates, and others, what is left after distillation?

519 Ans. They are distillates that are used for lubricating purposes for very common uses. I do mean that some are distillates and others what is left after distillation.

Cross-int. 19. What is the color of the oils referred to in the latter part of your last answer?

Ans. They are dark; dark green.

Cross-int. 20. You refer to both kinds, do you not?

Ans. I do.

Cross-int. 21. What is the distinguishing odor of the two kinds of lubricating oil referred to in the latter part of your answer to 18th cross-interrogatory; that is, those which are distillates and those left after distillation? And state whether or not they are distinguishable from each other by their odor.

Ans. I don't know that there is any great distinguishable difference; that is, they carry their own odor. Those left after distillation may have a stronger or more pungent odor.

Cross-int. 22. State whether the odor you have referred to in your last answer differs materially, and in what respect, from the odor of crude petroleum.

Ans. I don't know that I can describe the difference. It is very perceptible, however, to one familiar with the oils or substances.

Cross-int. 23. State whether the odor which you have described as a strong, pungent odor in your answer to cross-interrogatory 21, is stronger, more pungent, or more offensive than that of crude petroleum.

Ans. I believe it is.

Cross-int. 24. Now can you tell me whether or not you have such experience in dealing in petroleum oils as that you can distinguish paraffine lubricating oils from other petroleum oils, whether crude or distilled?

Ans. I think I have.

Cross-int. 25. By what characteristics do you distinguish them?

Ans. By color and odor and density.

Cross-int. 26. How by color?

Ans. I distinguish paraffine lubricating oils from petroleum lubricating oils by the paraffine being light amber, sometimes nearly white; and the petroleum lubricating oils—crude petroleum—being a dark green.

520 Cross-int. 27. I repeat question cross-interrogatory 24, as you perhaps did not understand it, stating that by "other petroleum oils," I meant oils not lubricating. Please answer it with this understanding.

Ans. I think I have.

Cross-int. 28. By what characteristics do you distinguish them?

Ans. By odor, color, and density.

Cross-int. 29. How by color?

Ans. Paraffine oils being light amber, sometimes nearly white; petroleum burning oils being generally nearly water-white, and carrying more of the blue or greenish tinge than some of the paraffines.

Cross-int. 30. How do you distinguish them by odor?

Ans. Some paraffines carry the odor of the distillate to some extent, while others are nearly free from any odor. Burning-oils generally carry the strong odor of the crude petroleum.

Cross-int. 31. When you speak of the odor of the distillate, what do you mean?

Ans. I mean the paraffine distillate.

Cross-int. 32. What do you mean by the odor of the distillate?

Ans. I mean the odor that is characteristic of the petroleum distillate. I don't know that I can describe it so as to be understood.

Cross-int. 33. Is it this strong, pungent, offensive odor of which you have before spoken?

Ans. It is, to some extent.

Cross-int. 34. Referring to your answer to cross interrogatory 28, how do you distinguish the oils there spoken of by density?

Ans. Paraffine oils range in density from twenty-three degrees to thirty-two degrees gravity Beaumé. The other oils range from twenty-three degrees to forty-five degrees; possibly lighter.

Cross-int. 35. For how long a time have you sold petroleum lubricating oil for Moorhouse, Merriam & Co., and their successors?

Ans. Nearly a year and a half. Between August, 1868, and April, 1870.

Cross-int. 36. What kind of oil, if any, did you sell for the firm of Mason, Pease & Moore, and between what dates?

Ans. I sold compounds of Smith's Ferry, Dunhard Creek, and animal oils, and crude petroleum lubricating oil, from November, 1865, to January, 1867.

Cross-int. 37. What was the character of the lubricating oil you sold for Moorhouse, Merriam & Co., and their successors?

521 Ans. They were paraffine oils, and compounds of paraffine and animal oils, and crude petroleum lubricating oil.

Cross-int. 38. What was the color, density, and odor of the paraffine lubricating oils first spoken of in your last answer?

Ans. The color was light amber, the odor that of petroleum or paraffine distillate; the density was from twenty-three degrees to thirty degrees, Beaumé.

Cross-int. 39. Did this oil give satisfaction in use?

Ans. When a certain per cent. of animal oils were added, it did; and in some instances I learned that it had been used satisfactorily without animal oil being added.

Cross-int. 40. What advantage, if any, has Merrill's deodorized heavy hydrocarbon oil over the oil spoken of in your last answer, in its use?

Ans. So far as I am informed, the advantages are in its freeness from odor and color.

Cross-int. 41. Were the lubricating oils you sold for Mason, Pease & Moore exclusively compounds of petroleum lubricating oil with animal oil?

Ans. They were not.

Cross-int. 42. State what petroleum lubricating oils you sold for them that were not such compounds.

Ans. West Virginia and Sugar Creek.

Cross-int. 43. What was the color of these oils?

Ans. Dark green.

Cross-int. 44. The odor of the light-colored paraffine oil which you sold for Moorhouse, Merriam & Co. was not very objectionable, was it?

Ans. For some purposes.

Cross-int. 45. For what mills was it sold, if you know?

Ans. For cotton and woolen mills more especially.

Cross-int. 46. What particular mills, if you know?

Ans. I know of none more than those. I am not able to designate the names.

Cross-int. 47. Can you tell the names of any parties to whom you sold that oil?

Ans. I can.

Cross-int. 48. Please give them.

522 Ans. They were dealers. Pennoch & Beeson, of Pittsburg; Hinman & Co., of Detroit; Page & Sprague, of Chicago; Chase, Hanford & Co., of Chicago; Armstrong & Co., of Chicago; Geo. Partridge & Co., St. Louis; McReady & Co., of Cincinnati, and others in those parts that I don't think of now.

Cross-int. 49. At what price did you sell that oil?

Ans. The prices arranged were from forty to forty-five cents per gallon. In some instances, small lots for fifty cents.

Cross-int. 50. Did you ever offer to sell any of that oil to Dr. Tweddle; and if so, at what price?

Ans. I can't say that I offered to sell it. I gave him prices, however, at his request, but would not agree to deliver any oil within a specified time. Forty-five cents was the price mentioned. He asked me if I would agree to deliver him five hundred barrels at that price.

Cross-int. 51. You did not sell any of that oil to Dr. Tweddle, did you?

Ans. I did not.

Cross-int. 52. Previous to the time when Dr. Tweddle asked you if you would agree to deliver him five hundred barrels of oil at the price you named in your answer to cross-interrogatory 50, had you not told him that you could supply in any quantity, or words to that effect?

Ans. I've no remembrance of having done so.

Cross-int. 53. Were you not agent for the Moorhouse oil at that time?

Ans. Indirectly I was. I was buying and selling their oils on my own account and taking orders to be shipped direct to the purchaser, when it was thought advisable and advantageous to do so.

Cross-int. 54. What quantity of that oil could you have furnished at that time?

Ans. I couldn't have furnished a barrel.

Cross-int. 55. You have stated that in February, 1870, Dr. Tweddle showed you a sample of his oil called neutral topaz. What was the character of the smell which that oil had?

Ans. It had very little odor, the least of any oil I had ever seen. The character was that of all other oils of that kind, but almost imperceptible.

Cross-int. 56. Was the little smell which it had that kind of smell which you have called a distillate smell?

523 Ans. I would not call it a distillate smell; it more resembled some animal oil—a fatty oil.

Cross-int. 57. Has the Merrill deodorized heavy hydrocarbon oil any smell; and, if so, what kind?

Ans. That that I have seen has no odor or smell whatever.

Cross-int. 58. What was the gravity of the oil which Dr. Tweddle showed you in February, 1870?

Ans. I do not know. I don't think he stated it at the time.

Cross-int. 59. Did you get from Dr. Tweddle a sample of his oil in February, 1870?

Ans. I did.

Cross-int. 60. Did you ever purchase any lubricating oil from Dr. Tweddle?

Ans. I never did.

Cross-int. 61. Did you ever try to purchase any from him?

Ans. I did, or tried to make arrangements for the sale of his oils.

Cross-int. 62. Did not Dr. Tweddle refuse to sell you any of his oils, excepting for cash?

Ans. I think his best terms were thirty days.

Cross-int. 63. Did not Dr. Tweddle decline or refuse to sell you otherwise than for cash?

Ans. I don't remember that he did. He stated that he could make no better terms than thirty days, and must have security for that, or something to that effect.

Cross int. 64. What description of smell did the spindle oil have which Dr. Tweddle showed you in February, 1869? Was it, or was it not, the same kind of smell as the oil of which you got a sample in February, 1870?

Ans. I've not stated that he showed me any oil in February, 1869. It was in December, 1868, or January, 1869.

Cross-int. 65. Please, then, answer the same question in regard to the oil you saw in December, 1868, or January, 1869.

Ans. It had more of the paraffine distillate odor previously referred to, and was much more similar to the paraffine oils of Cleveland manufacture in color and odor than that of the sample I saw in February, 1870.

Cross-int. 66. Then the smell was the same kind, but stronger than that of the sample of February, 1870, was it not?

524 Ans. I do not admit that it was. There was a similarity perceptible, but the paraffine distillate odor predominated.

Cross-int. 67. Did you try or offer to purchase any of that oil on or about December, 1868, or January, 1869?

Ans. As I have stated, I called on Dr. Tweddle at that time for the purpose of either purchasing or making arrangements for the sale of that oil.

Cross-int. 68. You considered that oil superior to the Moorhouse, Merriam & Co. lubricating oil, did you not?

Ans. I could see nothing which caused me to think it superior.

Cross-int. 69. Did you not consider it superior as an oil, but higher in price?

Ans. I considered it about equal as an oil, and much higher in price.

Cross-int. 70. What was the price Dr. Tweddle asked you?

Ans. It was about sixty cents, if I remember correctly.

Cross-int. 71. What was the price of the Moorhouse, Merriam & Co. oil at that time?

Ans. About forty-five.

Cross-int. 72. Did you not at that time make considerable effort to get the agency of Dr. Tweddle's oil? I refer to the spindle oil.

Ans. I made very little effort. I was more particularly desirous of getting a heavy dark oil for Eastern Pennsylvania, for the anthracite coal regions, at the time.

Cross-int. 73. Are you still engaged in the sale of paraffine oils?

Ans. I am not.

Cross-int. 74. What is your present business?

Ans. I have an engagement of recent date with the American Lubricating Oil Co., of Cleveland. They are not manufacturers of paraffine oil.

Cross-int. 75. What kind of lubricating oil does that company manufacture or deal in?

Ans. Their light oils are mostly compounds of paraffine and animal oils.

Cross-int. 76. What paraffine oil forms the basis of the compound you refer to as the light oils?

Ans. I am not familiar with all their grades, but I think they
525 are of Cleveland manufacture—that of Moorhouse & Freeman and Merriam & Morgan.

Cross-int. 77. State whether or not they use any of the Merrill deodorized heavy hydrocarbon oil.

Ans. I don't know that they do.

Cross-int. 78. Do you know that they do not?

Ans. No, sir.

Cross-int. 79. Who compose that firm?

Ans. I shall have to refer to the card for the names; I can't give their initials. Their names are Harmon, Jeannings, Blandin, and Finger.

Direct examination resumed:

Int. 22. Have you ever been engaged in the manufacture of oils?

Ans. If you call compounding manufacturing, I have, but not otherwise.

BYRON M. PECK.

Deposition of Charles E. Abbott, taken before H. Farnham Smith, special examiner, Monday, February 26, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainants.

Int. 1. What is your name, age, residence, and occupation?

Ans. Charles E. Abbott; forty-eight years of age. I reside in Malden, Mass. I am a counsellor at law.

Int. 2. Have you been employed by Mr. Merrill, the plaintiff in this case, as one of his counsel? If so, will you state when your employment commenced?

Ans. I have. It commenced in January, 1870.

Int. 3. What was your first service that you rendered him?

Ans. It was to go to Pittsburg, Penn., under instructions to get what information I could in regard to the manufacture and sale of lubricating oil by Dr. Tweddle.

526 Int. 4. State generally what you did while you were there.

Ans. I visited several refineries, and had interviews with numerous dealers in lubricating oils, and had interviews with various employees in the refineries.

Int. If, while you were there, you visited Dr. Tweddle's "Eclipse Refinery," and saw Dr. Tweddle himself, state what the object of such visits was, and what took place at such visits.

(Objected to.)

Ans. I did go to his works several times; went into them once under his escort. My object was to make that visit a part of my mission to Pittsburg. I had a short interview with Dr. Tweddle, told him I had been in some refineries and that I desired to go through his; that I had been informed generally in Pittsburg that his refinery was a very fine one. I also told him that I had a friend in Pittsburg who desired to go through with me, but that that friend couldn't go with me that morning, and had commissioned me to make some inquiries for him. The doctor gave me the information I wanted for that friend, so far as was convenient for him, and then went personally through the establishment with me.

Int. 6. Who was the friend to whom you referred?

Ans. John Langford, then of Pittsburg.

Int. 7. If you know the object for which he desired the information, state it.

Ans. I was assisting this friend in drawing up a circular to be addressed to the manufacturers of Pittsburg, and took the rough draft of that circular to Dr. Tweddle with me. He (Mr. Langford) had made efforts previously to get a note to the doctor to allow him to go in. Knowing that I was desirous of visiting it, he asked me to attend to this for him, or to get him in with me.

Int. 8. State whether or not you showed the doctor the draft of the circular which you had with you; and if you have that circular, or a copy of it, will you produce it?

Ans. I did; and I produce a copy, to be marked "Plaintiff's exhibit No. 94."

Int. 9. Was the paper that you showed to the doctor in writing or in print?

Ans. There were two papers, both in writing.

Int. 10. Had the circulars been printed at that time?

527 Ans. They had not. The object of seeing the doctor was to get some hints before printing; so far as Mr. Langford's interest were concerned. I had two objects; the other object being Mr. Merrill's interest.

Int. 11. If the information which you obtained relating to this circular was given to you by the doctor in writing, and you have now the writing, will you produce it and explain it, so far as may be necessary for our understanding of it?

Ans. The information was mostly verbal, of a general nature. He did make a few memoranda in writing, which I have here, and now produce, to be marked "Plaintiff's exhibit No. 95." This paper contains memoranda made both by the doctor and by myself, from his lips, and relate to both objects of my visit. All the memoranda are in my handwriting excepting the words "Vesta," "Kosmos," "National Rf."

Int. 12. Will you point out what there is upon this paper which relates to the information you desired to obtain in Mr. Merrill's interest?

Ans. The words "Gazette will contain Dr. Tweddle's outline;" "all use high heat except Dr. Tweddle;" "less steam."

Int. 13. If you obtained any further information relating to Mr. Merrill's interest at that interview, state what it was.

Ans. I obtained very little information from Dr. Tweddle. He remarked that his refinery was unlike other refineries; that he used steam instead of direct heat and alluded to lubricating oils two or three times. He wasn't inclined to follow up conversation in regard to them.

Int. 14. State whether or not he showed you samples of his oils.

Ans. He did not, any particular sample.

Int. 15. State whether or not he showed you his stills, and gave you any explanation as to the manner in which they operated, or as to their difference from stills used by other refiners.

Ans. He showed me three stills and a fourth still in process of manufacture. He was not then working either still. He gave no explanation, any further than the remark that he used steam instead of the direct heat.

Int. 16. State how much time you spent in examining the stills and whether you saw their internal construction, and had it explained to you.

528 Ans. It was a more general look at the outside of the stills; saw nothing of the inside, and had nothing explained in regard to the inside by him. He was disinclined to enlighten me minutely upon any point.

Int. 17. State whether or not you informed the doctor that you wished to obtain information relating to Mr. Merrill's interest.

Ans. I did not. I told him I had visited "The Standard," "The Citizens," and "The Hutchinson Refinery," and that they had all referred me to his if I wanted to see the best refinery.

Int. 18. You spoke of making several visits to his refinery. How many did you make in all, and were the others prior to or after this one?

Ans. I had been to his office on two, perhaps three, occasions prior to this; and on one occasion prior I had gone a little way into his refinery. These were all that I made to his refinery during that visit to Pittsburg.

Int. 19. State what took place when you first visited the doctor's office.

Ans. I was refused admittance. I saw a clerk in the office, and he informed me that the proprietor had left instructions for no one to visit the refinery.

Int. 20. State whether or not you asked permission to visit.

Ans. I always asked permission, with one exception. On one occasion there was no one in the office; I waited a few minutes and went into the refinery.

Int. 21. How far did you go on this occasion, and what took place?

Ans. I went a few rods in the direction of the boiler-room, I think; met some one who appeared to be in charge; asked him if I could go on through and look around. He informed me that I could not unless the doctor gave permission; that he had the strictest orders to let no one in.

Int. 22. Was this before the time when you saw the doctor.

Ans. It was. I never made any effort to go in after he had once taken me through.

Int. 23. When did you next visit Pittsburg upon business relating to this case?

Ans. The last of February, 1871.

Int. 24. State whether at this time Mr. Merrill was there with other counsel.

529 Ans. He was.

Int. 25. For what purpose were you present at Pittsburg in February, 1871?

Ans. I was there on the same business that I was there in 1870, for Mr. Merrill.

Int. 26. State a little more specifically the particular service which you were called upon to render at that time.

Ans. I was there to try and get additional information in regard to the production and sale of lubricating oil by Dr. Tweddle.

Int. 27. If in the prosecution of your enquiries upon this point you had an interview with one Joseph Clark, will you state when you first saw him, and what then passed between you?

(Objected to.)

Ans. I saw Joseph Clark first on the 6th of March, 1871, at the "Brilliant Works," above Sharpsburg. I asked him his name, and if he was the Joseph Clark who had formerly worked for Dr. Tweddle, and if he was still in his employment. He said that he formerly worked for

Dr. Tweddle, and that he was not working for him then. I asked him if he was willing to go down to Pittsburg and have a talk with me in regard to Dr. Tweddle's works. He said he had no objections. I told him I had been into the doctor's works some time previous; that I had a rude plan of them, and wanted to know if he could give me any additional information, and I would pay him for his time. I made a definite bargain with him for the day, and we took the train for Pittsburg and took a room at the Union Depot Hotel.

Int. 28. State what your bargain with him was.

(Objected to.)

Ans. I was to pay his bills, and give him five dollars for his day's work. He was to pay, and did pay, his own fares down, which I was to refund him.

Int. 29. State how long he was with you in the room at the Union Depot Hotel, and how the interview was terminated.

Ans. He was with me about three-quarters of an hour, when a bell-boy called at the door of the room, with a card and a request for him to come down stairs.

Int. 30. State generally what was the subject of conversation while in the room together.

530 Ans. It was in regard to Dr. Tweddle's lubricating oils.

Int. 31. State whether or not you made any memoranda in Clark's presence of what he then said, and whether you have those memoranda now?

(Objected to.)

Ans. I made a few memoranda at that time in the room, which I have here.

Int. 32. Will you read those memoranda?

(Objected to.)

Ans. I read from pages 20 to 24 inclusive of a memorandum-book which I kept at the time. "Wilkins and Brerreton, 4 years standard, 3 foreman, went with T. to Eclipse, and staked it out, snow on ground in January, '67. Still cast at Totten's foundry, at Pittsburg. Clark fitted it up in general, he being then in general charge. About May, when done. Oil was run in by vacuum—constant. Only now and then, still being filled, would have to stop running in, and draw off from the bottom the lubricating oil, dark green, had a smell, but not so strong as when it went into the still. Joseph Clark, 94 Federal street, Alleghany City; Saturday night to Monday morning, at his father's; wife and five children; North Fayette post-office, Alleghany County, 10 miles from Pittsburg on Pan Handle Railroad, gets off at Gregg's Station, which is nearest to his house, and that is one and a half miles; 2 cast-iron boxes in the still just alike; right and left partition in each box; 2-inch pipe runs from the outer case of the boxes; ¾-inch pipe from the inner case of the boxes through the 2-inch pipe, and the steam went in through the ¾-inch and back between the two pipes, the 2-inch being plugged up at the out end, then the oil was run in to drop on to these hot pipes. John Graces, first nice lub. oil about 18 months since, inside of that never got up anything near like the samples in the little still, or before I went to Aladdin. He agreed to have me go for 9 months, and no longer. T. was trying for nicer lub., but never got anything free from smell or light color."

Int. 33. Will you explain what you mean by "Wilkins and Brerreton" in the above memoranda?

(Objected to.)

Ans. Those are names Clark gave me as persons being connected

531 with refinery at Aladdin, where he was sent by Dr. Tweddle, as temporary superintendent.

Int. 34. What is to be understood by T., as used with memoranda?

(Counsel for respondent objected to this, and to any future questions which may be asked in explanation of the above written memoranda, to avoid repetition of the objection.)

Ans. T., whenever it occurs in these memoranda, means Dr. Tweddle.

Int. 35. What is the meaning of lub. when it occurs?

Ans. Lubricating oil from petroleum.

Int. 36. What samples were those which are mentioned in the memoranda?

(Objected to.)

Ans. They were two samples of petroleum lubricating oil which I had called Clark's attention to, and which he had examined.

Int. 37. What oils were they?

(Objected to.)

Ans. One of them was Mr. Merrill's manufacture and the other Dr. Tweddle's.

Int. 38. Do you know the names that were affixed to them? If so, give them.

Ans. I think Mr. Merrill called his "spindle oil." The other oil I obtained from a party who said it was Dr. Tweddle's neutral topaz oil.

Int. 39. Have you those samples now in your possession; if so, can you produce them to be marked as exhibits?

(Objected to.)

Ans. I have them, and produce them to be marked "Plaintiff's exhibits Nos. 96 and 97."

Int. 40. State which of these is Merrill oil, and which one said to be neutral topaz oil.

Ans. I havn't kept them distinguished in my mind from that time to this. I am not sure that the labels on them correspond to the oils. I only know that those are the two oils that I showed to Mr. Clark.

Int. 41. How much did Clark examine them?

Ans. He examined them very particularly, indeed. I made a special point of securing his careful examination of them. He smelt of them very carefully, indeed; stepped to the window with them; looked
532 through them; felt of the oils. I watched him very particularly while he was making the examination, and was entirely silent myself.

Int. 42. Will you state whether or not your memoranda contains all that he said about those samples, or about the manufacture of such oils by Dr. Tweddle, or whether or not in substance he repeated his statements, as contained in your memoranda more than once?

(Objected to.)

Ans. The memoranda does not contain all that he said. He was free to explain to me all that he knew, and said a good many things that I did not get down. He was very positive in regard to the fact that, to his knowledge, no oil had been made by Dr. Tweddle of that nature prior to his going to Aladdin. I did not inform him the reason why I wished to know. I was especially careful not to assist him in fixing the time. I was seeking his knowledge free from any influence of my own. He went back and made a second examination of these oils, and shook his head and said, "Nothing like them was made."

Adjourned.

TUESDAY, *February* 27.

Witness, after hearing answer read over, requested that words "to his knowledge," preceding words "no oil had been made," be erased from the answer.

Int. 43. You spoke of mentioning to Mr. Clark, when you first met him, that you had a plan relating to Dr. Tweddle's "Eclipse Refinery." Will you state what that plan was, and whether you showed it to Mr. Clark after you reached the hotel?

Ans. The plan was a rude outline of the works made by myself after I had visited them. I had the plan on the table, with other memoranda relating to the matter, at which we sat during our interview. I think Mr. Clark was called off before I had shown it to him, but I had spoken to him in regard to some portion of the works illustrated by the plan.

Int. 44. State whether or not Mr. Clark, while with you, made any sketch or plan of any part of Dr. Tweddle's refinery; and, if so, of what part?

(Objected to.)

Answer. He made a pencil plan on an 18mo. leaf of a book, intended to show the interior of the cast-iron still.

Int 45. If when Mr. Clark was called out of the room he said
533 anything to you about who it was that called him and about returning, state what it was.

(Objected to.)

Ans. He said that was his "boss" that sent for him, and he must answer. I asked him to wait half an hour or so, and sent a message down myself, that he would be down in that time. We then talked again in regard to the oil three or four minutes, and he then went down. That last talk related precisely to the fact that he had previously told me in regard to the time of the production of the nice lubricating oil. He said he would be right back.

Int. 46. State whether or not he did come back.

Ans. He didn't, unless he came back after I left. I waited there about three-quarters of an hour.

Int. 47. If you saw him again after that, state when and where, and what passed between you.

(Objected to.)

Ans. I saw him that same day again, on Sixth street, in Pittsburg, and went with him over to Alleghany City. We had a talk of from half to three-quarters of an hour in regard to his not coming back, and in regard to his change of position with reference to giving me information concerning the doctor's works.

Int. 48. If he said anything to you at that second interview in respect to what he had previously told you at the hotel, or in relation to giving you further information, will you state what it was, giving his language as nearly as you can?

(Objected to.)

Ans. He was not very approachable at this second interview. He said, however, that he didn't want to talk any more with me; that it wouldn't do for him to tell me anything more; that Dr. Tweddle would rather he were dead than to tell what he knew in regard to the matter; that he wouldn't go back of what he had told me, but that he did not dare to tell me any more. I asked him why he was not willing to go and finish the story which he had commenced in the morning; said if he did he would lose his situation. I reminded him that he was not at work for Dr. Tweddle then. He said that the parties were under Dr. Tweddle's influence. I then showed him that if they did remove him

there were enough other refineries in Pittsburgh where he
534 could get work, and that I wanted him to go on and finish up his agreement with me. He said that these oil-men were all linked together; that he had just got his family settled down, or made some allusion to his family being settled down; and that if he got the ill-will of the doctor he was sure of being broken up. I tried very hard to keep his moral courage up, so that he would be willing to tell the truth in regard to the matter; told him I didn't believe he would be broken up in Pittsburg if he simply told the truth in regard to Dr. Tweddle's establishment; that if any such trouble as that should accrue to him, I hadn't the slightest doubt I could get him a splendid situation up at Corry. He still refused to give any more light; seemed very much under fear of somebody or of something; whereupon I drew my wallet to pay him for his day; told him I was sorry he had got into difficulty through me; notwithstanding, I would pay him as I had agreed to. He refused to take any money. I reminded him that he was a laboring man, and that it was too bad for him to lose his day. He said he was not losing it; said he was under pay. I made three or four attempts to make him take pay for his fares, and dinner, and services. But he gave me distinctly to understand that he did not lose the day; that he was taken care of by other parties, and I did not even refund him his fares, as I had agreed to.

Int. 49. State whether or not you saw him again after that; and, if so, where.

Ans. I don't remember now having seen him again to speak to him.

Int. 50. When did you next visit Pittsburg in relation to Mr. Merrill's business?

Ans. In June of 1871.

Int. 51. State whether or not Mr. Merrill was there with other counsel at the same time.

Ans. Mr. Merrill, with other counsel, was at Pittsburg at the same time.

Int. 52. State whether or not, while there at that time, you visited the ruins of Dr. Tweddle's Eclipse Refinery, at Sharpsburg bridge.

Ans. I did.

Int. 53. State whether or not you made any examination of the cast-iron still you have referred to.

Ans. I did.

Int. 54. State whether or not you found on that still any evidences of the deposit of coke or tar; and, if so, what such evidences were.

535 Ans. I found a moist coke or tar round the bottom orifice of the still, and a dry, hard, cokey substance on a dome that was detached from the still but partly on it.

Int. 55. If you obtained any samples of these substances, will you produce them as exhibits, stating from what parts of the still you obtained them?

Ans. I obtained a sample of each. The tin box produced, and marked "Plaintiff's exhibit, No. 98," contains the tar or moist coke taken from the bottom orifice, and a memorandum which I made at the time, in these words:

"Material taken from the orifice of the bottom outlet of the old still in the ruins of the 'Eclipse,' at Pittsburg. Taken June 20, 1871, by Herman Kaler and myself. June 27, 1871, given to Joshua Merrill.

(Signed) "C. E. ABBOTT."

The tin box produced, and marked "Plaintiff's exhibit, No. 99," con-

tains the dry, hard, cokey substance taken from the dome of the still, and memorandum made by me at the time, in these words:

"Material taken June 20, 1871, from the inside of the cast-iron dome, inclined upon the still at 'Eclipse' ruins, Pittsburg, about one foot from the end. Herman Kaler assisted me. In my possession till 27th June, when Joshua Merrill takes it.

(Signed) "C. E. ABBOTT."

Int. 56. What quantity of dry coke in the dome of that still should you judge there might have been when you saw it?

Ans. Half a peck, or more.

Int. 57. Did you visit Pittsburg again in relation to Mr. Merrill's business? If so, when?

Ans. I was there in October, 1871, but did very little concerning this matter. Saw four or five parties I had previously interviewed. And I was there again about the first of February, 1872.

Int. 58. What was the object of your last visit?

(Objected to.)

Ans. I went for Mr. Merrill, to see if I could get any additional information in regard to this suit.

Int. 59. State whether or not it was a part of the object of your visit also to see if you could induce witnesses to come to Boston to give their testimony, instead of having it taken in Pittsburg.

536 Ans. Yes; I went out under those as a part of my instructions.

Int. 60. State whether or not you made arrangements with Herman Kaler to come to Boston and give his testimony; how much you agreed to pay him; and how much you have actually paid him.

Ans. I made a bargain with Kaler to come with me and give what information he could; and he was to have for his services thirty dollars a week and his expenses; and I paid him that.

Int. 61. If you also made arrangements with Mr. Peck, who has been examined as a witness, to come to Boston and give his testimony, state what the arrangement was.

Ans. I made an arrangement with Mr. Peck to come to Boston for ten dollars a day, he to take care of himself, excepting that I was to pay his straight fares.

Int. 62. State whether or not at any of your visits at Pittsburg you entered your arrival upon the hotel register under an assumed name; and, if so, state at what visit or visits that was, and at what hotel, and under what name, and for what reason.

Ans. In June, 1871, I registered myself at the Monongahela House, as Rufus Spaulding, of Irasburg, Vermont. I had two objects in keeping my own name out of sight. One was, that I might make some further investigations in this matter, and because I feared Dr. Tweddle might seek to obstruct me. The other reason was that I wished to inform myself more particularly in regard to some threatening remarks that had been reported as having been made by Dr. Tweddle with reference to myself.

Int. 63. Will you produce the memorandum-book that you have referred to as containing the minutes of what was *sent* to you by Joseph Clark, at your interview at the hotel, to be made an exhibit in the case?

Ans. I will; and produce the book, to be marked "Plaintiff's exhibit, No. 100."

Cross-examination by Causten Browne, esq., in behalf of the respondent:

Cross-int. 1. Are you a member of the bar of any of the United States courts?

Ans. I have been admitted to practise in the United States courts.

537 Cross-int. 2. Which of them, and when?

Ans. Circuit and district courts of this circuit, about three years ago.

Cross-int. 3. What services have you rendered as counsel for the plaintiff in this cause, not including the investigations as to facts which you have referred to?

Ans. That has been my only department in this cause.

Cross-int. 4. How long have you known your friend Mr. John Langford, of Pittsburg?

Ans. About two years.

Cross-int. 5. Who introduced you to him?

Ans. I don't remember how I first got acquainted with him. It was at a hotel in Pittsburg; an accidental acquaintance.

Cross-int. 6. Were you stopping at that hotel at that time?

Ans. I was at that time.

Cross-int. 7. Registered under your own name?

Ans. I think I was. I have no remembrance otherwise.

Cross-int. 8. Did you register yourself at any Pittsburg hotel under a fictitious name more than once?

Ans. I registered my name at the Robinson House in February, 1872, as G. Morrill, New Hampshire. I have no remembrance of any other occasions on which I registered myself under another name then. I will add that at both these hotels the proprietors knew my real address, and I so informed them.

Cross-int. 9. Will you give us all the instances, if any, in which you registered yourself at a Pittsburg hotel under a fictitious name, besides the two instances you have mentioned, viz, Rufus Spaulding at the Monongahela, and G. Morrill at the Robinson?

Ans. I haven't, among my memoranda of those trips, any other instances, nor do I remember any other, but presume I may have used that precaution several times while trying to get at the truth in this matter, since I learned that Dr. Tweddle was the principal in the party that spirited away from my employment Jo. Clark.

Cross-int. 10. I will extend the last question to Alleghany. Have you any further answer to make?

Ans. Don't think I ever used any fictitious name in Alleghany,

538 nor ever stopped at any hotel there; but have visited a good deal in Alleghany under my own name.

Cross-int. 11. Did you register yourself at the Union Depot Hotel when you went there with Clark?

Ans. Yes. "Chas. E. Abbott, Boston, and friend, city."

Cross-int. 12. What hotel was it that you were stopping at when you made the acquaintance of Mr. Langford?

Ans. I don't remember when the acquaintance commenced. I stopped that trip part of the time at the St. Charles, and part of the time at the St. James. I think I first saw him at the St. James, but am not sure.

Cross-int. 13. How long were you in Pittsburg that trip?

Ans. The whole trip, including passages, absorbed thirty-two days.

Cross-int. 14. Were you ever at Dr. Tweddle's works before that trip?

Ans. This was the trip of February, 1870. I was never there before.

Cross-int. 15. This was the trip, if I am right, during which you made several visits to his works, and finally had a personal interview with him?

Ans. That is correct.

Cross-int. 16. What is Mr. Langford's business, and where does he live in Pittsburg?

Ans. He did live at East Liberty. His place of business was over James T. Brady's bank, but he is broken up there now, I understand. He managed a Trade Protection Agency.

Cros-int. 17. What sort of an institution is that?

Ans. I don't know anything about it.

Cross-int. 18. Do you know of your own knowledge anything about the nature of Mr. Langford's actual employment at the time you made his acquaintance?

Ans. Only from what he had told me, and from what he was apparently engaged in. From what he told me, and from what I observed.

Cross-int. 19. Please describe his place of business at that time.

Ans. He had at that time a desk-room over W. Haven & Co.'s book store.

Cross-int. 20. Did you report to him the result of your interview with Dr. Tweddle?

Ans. I did.

539 Cross-int. 21. Are you sure of it?

Ans. I am.

Cross-int. 22. Did you see Mr. Langford during that trip in Pittsburg more than twice?

Ans. I did.

Cross-int. 23. How many times, as nearly as you can remember?

Ans. About fifty; say thirty or forty.

Cross-int. 24. Do you know the Mr. Haven that you mentioned just now?

Ans. Mr. Langford introduced me to the senior Haven, and I think also to the junior one. I was in their store in connection with seeing Langford, I think, some six or eight times.

Cross-int. 25. Did your business with Langford include Mr. Haven?

Ans. It did.

Cross-int. 26. How.

Ans. I was endeavoring to get a letter to Dr. Tweddle that would give me some special facilities for getting through his works, and Langford had secured that one of the Havens should get such a letter through one of the doctor's business associates; and I went down to the store several times for that letter. I had previously exhausted my resources for getting in.

Cross-int. 27. Did you get the letter?

Ans. I did not get the letter.

Cross-int. 28. Dr. Tweddle boards at the Monongahela House, I believe, and did in June, 1871?

Ans. He did in June, 1871, and the clerk informed me last month that he still boarded there.

Cross-int. 29. You registered yourself in June, 1871, under an assumed name, as Rufus Spaulding. Was this before or after Dr. Tweddle had, as you say, spirited away from your employment Jo. Clark?

Ans. After.

Cross-int. 30. Did you go into the dining-room of the hotel regularly to get your meals, in June, 1871?

Ans. I took my meals there, but not very regularly or at very regular

hours; in the dining-room, usually very late, and usually two meals a day.

Cross-int. 31. Did you frequently see Dr. Tweddle in the dining-room during that trip?

540 Ans. Being uncertain whether he would recognize me, I avoided him, and saw him but a very few times. He was very late at breakfast, and that cleared one meal, and I was very late at dinner, and that cleared the other; supper I went without.

Cross-int. 32. Did you give the proprietor of the Monongahela House your true name and address?

Ans. I gave it to Mr. Wilson and to one other clerk, but not directly to the proprietor. Told him who I was, and under whose direction I was, and they gave me my mail in my own name.

Cross-int. 33. When you had your interview with Dr. Tweddle, in February, 1870, how did you introduce yourself, and whose name did you give as an introduction?

Ans. If I gave any name, I gave my own name. My impression is I gave him my own name. I did not inform him that I was in the interest of Mr. Merrill, or that I was sent there by him, but that Mr. Hutchinson and some others had told me that he had a very fine refinery, and that I wanted to go through it.

Cross-int. 34. Did you mention to him the name of Mr. Langford or of Mr. Haven?

Ans. I did not mention Mr. Haven's name. I think I did Mr. Langford's. If I didn't, I referred to him a person who proposed to issue a history of the manufacturers of Pittsburg, and showed him a sort of prospectus, written mostly in Mr. Langford's hand, with some little interlineations in mine.

Cross-int. 35. Were you in any way connected with Mr. Langford in getting up the work you have mentioned?

Ans. I had given him some advice in regard to getting up his circular, in consideration of his endeavors to get this introductory letter. I knew what his business was, and he did not know what mine was.

Cross-int. 36. You say you registered yourself several times at Pittsburg hotels under assumed names. Did you introduce yourself to anybody, either verbally or by letter, under an assumed name while you were in Pittsburg on this business of Mr. Merrill's?

Ans. Never by letter, and I never introduced myself verbally under an assumed name. One person asked me my name, and I told him to call me Brown.

541 Cross-int. 37. Did you never write any letters to anybody while in Pittsburg about this business of Mr. Merrill's, signing a fictitious name?

Ans. I have no remembrance of writing any letter to anybody while I was in Pittsburg, under a fictitious name. I don't think I ever did. I only had one general object in using a fictitious name. I was known by two or three hundred people, there and at Alleghany, by my real name.

Cross-int. 38. And what was that one real object?

Ans. That I might not be interfered with in my business by Dr. Tweddle. I don't think I ever took any such precaution until after he got Clark away from me.

Cross-int. 39. Have you got in your possession any memorandum book, other than the one from which you have read, in which you made minutes of what you saw, heard or did at Pittsburg?

Ans. Yes, sir.

Cross-int. 40. Did you make any memorandum in that book of any names appearing on the register at the Monongahela House.

Ans. I made a minute on some memorandum book or slip of paper of some names of persons on hotel registers at Pittsburg, at various times. I can't find them now, excepting that I have found "J. R. Bartlett, of Boston, and A. M. Nivins, of New York, at room 69, at the Union Depot, February 12, 1870.

Cross-int. 41. Can you recall any of these names, excepting Mr. Bartlett's and Mr. Nivins'?

Ans. I think I took the name of Price once, of Providence.

Cross-int. 42. Don't you remember copying from the register of the Monongahela House, in June 1871, the name of Mr. Lannahan, who was then stopping there?

Ans. I do remember copying four names, not into a memorandum book, but onto a slip of paper, and one of them was Lannahan, another was Charles or Charles E. Abbott. The other two I can't recall, but I understood from the clerk that those were not real arrivals.

Cross-int. 43. What were they on the book for?

Ans. I asked the clerk that question and he told me to ask Dr. Tweddle.

Cross-int. 44. What was the name of the clerk that told you that?

Ans. I don't know his name, but I can describe him so that any
542 man of good sagacity can find out his name. It was one of the day-clerks, a man in the vicinity of forty-five or fifty; no whiskers or moustache; hair, I should think might be a light brown; and his name is not Wilson; that will fix him, I think, sure.

Cross-int. 45. Who was Wilson?

Ans. A day-clerk.

Cross-int. 46. Who was the night-clerk?

Ans. I don't know his name. He was younger than either; about twenty-five years of age.

Cross-int. 47. When the clerk you first named told you to ask Dr. Tweddle about those fictitious names on the register, did you make any reply? If so, state it.

Ans. I did make some sort of a reply; in substance, that I understood the joke.

Cross-int. 48. What joke?

Ans. In getting my name down there when I had been entered fictitiously.

Cross-int. 49. You mean that you understood the clerk to mean that Dr. Tweddle had written those names there?

Ans. No; not that he had written them, but that the doctor was behind it. I pressed the clerk pretty hard for an explanation. He laughed, and referred me to Dr. Tweddle for further light. These four names were all in one hand.

Cross-int. 50. You understood him to mean, then, that Dr. Tweddle had caused those names to be written there, did you?

Ans. He didn't say distinctly in those words, but gave me very clearly to understand that, and nothing else. I had two, if not three, interviews with him on the matter. I remember of giving him one particular reason why I wanted to know whether they were fictitious or real names, which was in regard to my letters, which came to the house in my own name. I am quite sure, on reflection, that the name of the clerk was Henderson.

Cross-int. 51. Do you mean us to understand that you supposed that

Dr. Tweddle had caused those names to be written there, including your own, with a view to intercepting your correspondence?

Ans. Nothing of the sort. That wasn't the idea. The idea in my mind was, that if there was another person of the same name with
543 mine there, he might get my letters, and I wanted to find out whether that was the fact, or whether Dr. Tweddle had taken that course, to show that he knew I was there under a fictitious name.

Cross-int. 52. Did not the clerk, in answer to some question of yours about those four names, tell you that he or the night-clerk had written them on the register about midnight the night before, just to fill up the page, these names being the last on the page?

Ans. I never knew who wrote them, or in whose hands, and was never told, and don't know now but they were in Dr. Tweddle's hand. No other clerk was referred to, so far as I remember. I think all my talk was with Henderson, but am not sure.

Cross-int. 53. Did you preserve the piece of paper or book on which you copied these names?

Ans. I think I gave that piece of paper to Mr. Downer; I haven't seen it since; I don't think it is among my books and papers. If I didn't give it to Mr. Downer, I showed it to him.

Cross-int. 54. What did you want with the other fictitious signatures besides that of your name?

Ans. Had my name been in one hand and the others different I should only have taken my own. It was the association my name was in. I was thinking perhaps that some of my party might recognize some of the other names.

Cross-int. 55. Mr. Downer and Mr. Merrill were at the hotel at the time.

Ans. They were.

Cross-int. 56. Did you write this letter, now produced, and to be marked "Defendant's exhibit No. 101?"

Ans. I did not, but I recollect one of the names as being one of the four. I remember the name of Curtis.

Cross-int. 57. Did you ever see the letter before?

Ans. I don't think I ever did. I think those are the names that were on the register.

Cross-int. 58. Did any one ever tell you about it, or who had written it?

Ans. After I went back to the clerk the second time, and pressed him still closer to let me know in regard to those names, I became satisfied from what he said, that they were not real arrivals. I then told
544 some one of the party, I don't remember which one, that I guessed that was all a joke; that I didn't believe there were any such persons there; whereupon Mr. Downer said that he guessed that was the correct solution, and made some remark like this: that he would joke Mr. Brown about it when he saw him, or something to that amount or write him a note. I don't remember definitely. Whatever he said he said in a jocose way, laughing. I never knew that he sent a letter; knew that the whole affair was talked over and treated as a good-natured joke intended on me.

Cross-int. 59. What I asked you was whether any one ever told you about that letter, or who had written it. Will you answer just that question and nothing else?

Ans. Nobody, unless it was Mr. Downer.

Cross-int. 60. Do you mean by the words "unless it was Mr. Downer," to imply that you think he told you?

Ans. I don't think he did tell me that he had written any letter. I only know that when I reported to him the reference the clerk gave me, he laughed and said it was a good joke; he guessed Browne had a hand in it, or something to that amount. There wasn't any offence taken by anybody in the party. It was understood as a sort of a sell on me.

Cross-int. 61. What do you mean by no offence being taken? What party do you refer to?

Ans. I mean that Mr. Merrill and his counsel, and Mr. Downer and myself, all came to the belief that Dr. Tweddle or his counsel had brought this about to let us know that they knew that Rufus Spaulding meant Charles E. Abbott, and that was a good deal of merriment to them. I remember now that I asked these gentlemen the initials of Mr. Curtis, the lawyer. I was myself somewhat exercised at first about it. I believe myself, from what the clerk told me, that Dr. Tweddle engineered it. Mr. Downer seemed to think that it was a little piece of good-natured pleasantry of Mr. Browne's.

Cross-int. 62. Do you recognize the envelope now produced, and the address upon it, Exhibit 102?

Ans. I never saw it until now, that I remember.

Cross-int. 63. Did you not drop in the city post-office, on the day on which that envelope is post-marked, a letter enclosed in that envelope?

Ans. I don't remember ever dropping a letter there directed to Mr. Browne. If I did I have forgotten it.

545 Cross-int. 64. Did any of the gentlemen of your party, as you call it, ever say anything to Mr. Browne or Dr. Tweddle about this joke, as you call it?

Ans. I never heard either of the party say anything to either Mr. Browne or Dr. Tweddle about it. I never heard the subject alluded to since that time.

Cross-int. 65. What time of day was it when you copied these four fictitious names from the register?

Ans. I am not sure—think it was in the evening.

Cross-int. 66. How soon after you copied them did you speak of them to Mr. Downer or any of his party?

Ans. I didn't copy them when I first saw them, but reported to some of the party that my name was on the book there, and I afterwards copied them.

Cross-int. 67. How soon after you copied them did you give them to Mr. Downer or any one else?

Ans. I don't know how soon. It was right away; and I am not sure that I gave them the paper. I think I copied them on an old envelope or little piece of paper, and asked them if they knew any of those parties, or something to that amount.

Adjourned.

WEDNESDAY, *March* 6, 1872.

Direct examination resumed:

Int. 64. Have you any circular in your possession furnished you by Mr. Langford, showing the character of the Trade Protection Union, with which he was connected? If so, please produce it as an exhibit, and state when he furnished it to you.

(Objected to.)

Ans. I have, and produce it, marked "Exhibit No. 117." It was furnished me by Mr. Langford, I think as late as the middle of 1870, but I can't fix the date very accurately. It was furnished me some months subsequently to the printing of the original prospectus.

CHARLES E. ABBOTT.

546 *Plaintiff's Exhibit No* 94.—*H. Farnam Smith, special examiner.*

To the manufacturers of Pittsburgh:

The undersigned purposes, at as early a date as compatible with the importance of the object in view, to publish a "History of the Manufactures of Pittsburgh, Allegheny, Birmingham, and vicinity—their Rise and Progress."

It is true, various works have from time to time been issued, giving sketches of some of our manufactures, yet none have contained a full, lucid, and reliable history of all. The subject having been thus sadly neglected, the undersigned has imposed upon himself the onerous duty of doing full justice to that energy and enterprise of our manufacturers which have led to results unsurpassed in the history of any other city on the continent of America.

It is presumed every manufacturer will at once see the incalculable benefit this work must be to them, bringing, as it will, before the millions of consumers in the United States and Canada, the immense resources and importance of Pittsburgh as the great manufacturing centre of this vast republic.

Taking all the above facts into consideration, the undersigned confidently relies upon the co-operation of every manufacturer in the vicinity for assistance in furnishing him with statistics of, and granting him the entré' to their works.

Each manufacturer receiving this circular is requested to forward, at his very earliest convenience, the following information, viz:

1st. Description of buildings and grounds connected with their works. When, by whom, and under what circumstances established. Their rise and progress.

2d. Value of products. Estimate of capital employed, not for publication, but to form a correct estimate of the total capital employed in each branch of manufactures.

3d. Description of articles manufactured, and in what quantities.

4th. Number and description of employees (whether men, women, or boys,) and amount of wages paid weekly.

5th. Any other item of information connected with works, likely
547 to be interesting or of value to the public at large, and bring the resources of Pittsburgh more prominently before them.

All parties are requested to give the use of any books, etc., they may possess bearing on Pittsburgh manufacturers, and they can rely upon the greatest care being taken thereof and their safe and immediate return to the owners.

You are respectfully requested to give the above your immediate attention, and forward all communications to

JOHN LANGFORD,
Box 520 *P. O., Pittsburgh.*

Or care of—W. S. HAVEN & Co., *Printers,*
Cor. Wood st. and Third av., Pittsburgh, Pa.

Plaintiff's Exhibit No. 95.—*H. Farnam Smith, special examiner.*

"Gazette" will contain Dr. Tweddle's outline.
All use high heat ex. Dr. T. uses steam.
1. Brilliant, P.
1. "Eclipse." Dr. H. C. Tweddle, prest.
2. "Standard." Hutchinson, prest.
3. "Citizens," refined pet.

4. "Hutchinson's." Hutchinson, prest. Phillips, supt.
"Eclipse." P.
"Eagle." P.
Vesta. P. 61 Kerosene.
Cosmos. P. 66 "Albert 6 val."
National Rf. Co. or "Bogglead."

548 *Defendants' Exhibit No.* 101.—*H. Farnam Smith, special examiner.*

PITTSBURG, *June* 13, '71.

C. AUSTIN BROWN, Esq.:

MY DEAR SIR: We arrived in this smoky city early this morning, and have taken rooms at No. , Monongahela House, and wish to have your known valuable services, for we are in much trouble and tribulation, and we know nowhere else to get relief. Relying on your known kindness we will state our case freely, and would state we are entirely conscientious in what we wish, which is simple to know beforehand what others know afterwards, and we know only this relief. You undoubtedly have much influence over those who alone can furnish it; we see how expert they are in drossly, and how they excel in vacuum, especially when steam and superheated steam is up. We would be candid, we cannot afford to pay until we have realized, as we think we can show you, am the gentleman who introduced us to our excellent hotel. Will you assist us?

Yours, with much respect, and much regard,
CHARLES A. LANAHAN.
HENRY W. BROWN.
CHAS. ABBOT.
P. P. CURTIS.

Complainant's Exhibit No. 117.—*H. Farnam Smith, special examiner.*

PITTSBURG TRADE PROTECTION AGENCY,
OFFICE, BRADY'S BANK BUILDING,
Cor. Wood street and Fourth avenue.

President, N. P. SAWYER. *Vice-President*, WM. DOUGLAS.
Counsel J. M. GAZZAN & CO.

549 DIRECTORS.

CHAS. MEYRAN, of Meyran & Seidle.
J. W. MCFARLAND, of McFarland & Collins.
W. H. LEMON, of Lemon & Weise.
A. P. BURCHFIELD, of Jos. Horne & Co.
W. B. HUNTER, of W. S. Haven & Co.
J. C. MATTERN, druggist.

At the urgent request of several prominent merchants of the city, the undersigned have determined on establishing an agency, as above, to protect business houses against loss from the encroachments of the dishonest and otherwise unworthy of credit, and trust the support accorded them will be commensurate with the advantages conferred on the wholesale and retail trade of Pittsburgh, Allegheny, and vicinity.

Every one engaged in business, involving as it does a certain proportion of credit-trade, has felt the difficulty in a large city of obtain-

ing promptly reliable information, as to the standing of the numerous applicants for credit, some of whom, for the best of reasons, are anxious to open new accounts; and, frequently, after diligent enquiry, and where apparently satisfactory references have been obtained, the dealer finds he has been made the new victim of the dishonest debtor, who probabiy has for years lived upon the public, without the slightest intention of paying any one.

Now, any practical system that is calculated to afford relief or protection to the trade against such losses is certainly worthy of due consideration and unlimited support; and it is confidently believed that the Pittsburgh Trade Protection Agency provides, under the proposed arrangements, the means of guarding against losses of this nature, by furnishing (to subscribers only) the name of every individual unworthy of credit; and this information must necessarily be reliable, coming as it does, to a great extent, from the subscribers themselves, and a careful personal enquiry by the managers.

It is not claimed that the system we have adopted is absolutely perfect, but it has been approved of by a large number of the oldest and most prominent business men in the city with whom the man-
550 agers have consulted. Mean time, the present arrangements are submitted as simple, practical, and calculated to afford present relief to the city trade. No doubt, in the course of a year, some valuable suggestions may be received and adopted, if approved of by the board of directors, who are well known, active, and experienced business men, who have kindly consented to act for the purpose of consulting with and advising the managers in all matters connected with and appertaining to the most correct and simple manner of carrying out the objects of this agency.

A debtor who cannot or will not make an effort to pay the whole or a portion of his account within from three to six months after the usual term of credit has expired, or to afford him the greatest possible latitude, say a year, ought certainly be considered dangerous; and his name should be recorded on the books of the agency as untrustworthy, that all other subscribers may be protected from loss by giving him credit. At the same time, subscribers should exercise the greatest caution that they do not hand to the agency, through malice or carelessness, the name of any debtor who may be suffering from temporary embarrassment only, when he makes any exertion to pay even a portion of his account. And if a subscriber finds he has returned the name of any debtor who afterwards settles the account, he is required to immediately notify the managers, that the alteration may be made on the books of agency.

HAVEN, LANGFORD & CO.,
Managers.

Refer, by permission, to—

Col. Wm. Phillips,
James I. Bennett, Esq.,
Jas. T. Brady, Esq.,
C. H. Love, Esq.,
Hon. Thos. Mellen,
John B. McFadden, Esq.,
Robt. C. Schmertz, Esq.,
Paul. Hugus, Esq.

COLLECTION DEPARTMENT.

In connection with the foregoing, the managers beg to intimate that it is their intention to establish a collection department, under their immediate personal control, to be managed on systematic principles,

551 and with a due regard to the interests of their subscribers and the prompt settlement of all matters entrusted to them.

The subscribers must at once see the paramount advantages that will accrue to them in having their business done through this agency, possessing as it will such peculiar facilities for collecting that it can be done more promptly and at lower rates than can possibly be obtained by any other means.

This department is established for the exclusive benefit of subscribers to the Pittsburgh Trade Protection Agency.

DIRECTIONS TO SUBSCRIBERS.

Having filled up the printed form provided for the purpose, with the name, etc., of every person from whom, in their own business, subscribers have been unable to collect their accounts, they are requested to sign and send it in a closed envelope to Haven, Langford & Co., managers, 88 Fourth avenue, corner Wood street, Pittsburg, or lock box 435 P. O. This information will be exclusively the property of the agency, and be recorded on its books for the use of subscribers.

Each subscriber will continue this system when he finds he has made a bad debt, in order that every dangerous name may be recorded day by day. In this way the agency must become a really valuable assistance and protection to the city trade.

The agency being under the personal direction of the managers, (no others, excepting the directors and book-keeper, having access to the books,) none but they will know which subscriber or subscribers have furnished the information that is at the disposal of all.

☞ When a subscriber has an application for credit from any person about whom he has the slightest doubt, he should at once send to the office for information, using the blank form issued for that purpose. ☜

Terms of subscription..... $25 per annum.

552 *Deposition of William Atwood.*

WILLIAM ATWOOD, having been duly sworn, doth depose and say in answer to interrogatories by Chauncey Smith, esq., of counsel for complainant, as follows, viz:

FEB. 28, 1872.

Int. 1. State your name, age, residence, and occupation.

Ans. William Atwood; age, 41 years; residence, Cape Elizabeth, Maine; occupation, manufacturing chemist.

Int. 2. Have you been previously examined as a witness in this case?

Ans. I have.

Int. 3. When manufacturers of illuminating oil from petroleum desire to produce the largest quantity of such oil from a given amount of petroleum, what means are resorted to for effecting this?

Ans. After distilling the oil that runs readily from the still, of such gravity as is desirable for illuminating oil, the oil commencing to run high-colored, of low gravity, the fire is slacked, so that a partial condensation takes place in the top or dome of the still, for which purpose the top of the still is often built of larger capacity than would otherwise be necessary, whereby the heavy oil is condensed and returned back into the body of the still, and redistilled until it is changed in character as to color and gravity, the gravity being raised, the oil changed from a heavy

oil to an oil suitable for illuminating purposes, or, in the language of the refiners, the oil is cracked.

Int. 4. To what extent can this cracking be carried, if desired; and what products besides illuminating oil are obtained from this mode of treating the oil?

Ans. The process of cracking can be carried until the oil is all changed into naphtha, gas, and coke, if desired. The products at any time when cracking is taking place are always gas, naphthas, and oils of lighter gravity than that being cracked, leaving a residue of coke in the still, either free or in a fixed combination.

Int. 5. Have you examined the specification of a patent granted to Herbert W. C. Tweddle February 15, 1870, of which a certified copy is now produced as an exhibit in this case, marked "Complainant's
553 exhibit No. 103," and do you understand the process or processes described therein?

(Objected to.)

Ans. I have examined that specification, and understand the processes therein described.

Int. 6. In this packet I find what I understand to be a description of methods of distillation practised prior to the invention described, which is as follows:

"Previous to the date of my invention, the efforts of oil manufacturers were chiefly directed to securing from the crude oil the largest possible percentage of illuminating oil, in which oil the presence of paraffine was objectionable.

"Since the early history of oil distillation, a fire heat of high temperature has been commonly applied to the outside of the still. When from forty-five to sixty per centum of the oil was thus distilled over, the distillate marked forty-three or forty-four degrees, Beaumé hydrometer, and was yellow in color and objectionable in odor. In order to obviate these objections, various devices were adopted, such as high domes, goose-necks, etc., the immediate object being to decompose the heavier oils, which contained the paraffine, and prevent them from passing over into the condenser, as a result of which change the product was made lighter both in gravity and color.

"By the use of such appliances, the vapors of the heavier oils, which contain the paraffine, are condensed in the dome or goose-neck, and fall back into the still, where they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless, and a part forming carbides of hydrogen, or other non-condensable gases and water, and another portion being precipitated or adhering to the sides or top of the still as solid carbonaceous matter. The residuum left in the stills as the result of such process of distillation (of which residuum the carbonaceous matter last referred to formed a large part,) amounts to from three to ten per cent. of the oil distilled, and which sometimes exists in a tarry mass, or may be reduced to a coke."

Will you state whether or not you understood the passage just quoted as being a description of what you have just referred to as
554 the process for cracking oils, and whether you find it to be a correct description, substantially, both as to the modes of procedure and to the conditions relating to the structure of the stills referred to in the passages?

Ans. It is a description of the process of cracking oils, and is substantially correct, both as to structure of stills and as to the process of cracking.

Int. 7. Have you been accustomed to use this process in your own manufactory, and have you observed it as carried on by other manufacturers?

Ans. I have.

Int. 8. In the passage that I have read, there is this statement of the products obtained by the process: "By the use of such appliances the vapors of the heavier oils, which contain the paraffine, are condensed in the dome or goose-neck, and fall back into the still, where they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless; a part forming carbides of hydrogen, or other non-condensable gases and water, and another portion being precipitated or adhering to the sides and top of the still in solid carbonaceous matter." Have you ever observed this precipitation of solid carbonaceous matter around the top and sides of a still when the cracking process is carried on? And, if so, will you state to what extent you have observed it?

Ans. I have observed the precipitation of carbonaceous matter around the tops and sides of the still in all cases where cracking was taking place; to a small extent, however, to the whole amount of the carbonaceous matter or color formed by the process.

Int. 9. Have you examined the testimony of Dr. Tweddle in this case, particularly as to the description he gives of a cast-iron still erected by him at the Eclipse Refinery, so-called, near Sharpsburg, in 1867; and, if so, will you state whether you understand the construction of the still, as described by him, and the manner of using it?

Ans. I have examined his testimony, particularly in regard to the construction of such still, and think I understand its construction and the manner of using it. The testimony refers to a model that I have not seen, but I think I understand it without seeing it.

Int. 10. I wish to call your attention to that part of the doctor's
555 description of his still which is contained in question to cross-interrogatories 54 and 55, and in his answers to cross-interrogatories 345–351, inclusive. Will you state how far you find the still, as described by the doctor, and particularly in answer to these questions, to conform to the conditions of construction usually resorted to by oil distillers where the cracking process was to be carried on, and to the conditions of construction which are specified in the passage from Dr. Tweddle's patent, which I have referred to?

Ans. I find the still to be constructed for cracking, with a very high capacity for that purpose.

Int. 11. Look at answers given by Chas. E. Abbott in his deposition in this case, in answer to interrogatories 54, 55, and 56, and to the samples of material which he then states he took from the iron still referred to, and which are marked "Exhibits 98 and 99," respectively, and state whether or not you can form any judgment from his statement and from the exhibits as to whether or not such deposition of carbonaceous matter had taken place in that still as commonly takes place in the cracking process, and such as is described in the passages from Dr. Tweddle's patent, to which I have referred.

Ans. From his description and the samples exhibited, I should say that cracking had taken place to a very considerable extent.

Adjourned to 3.30 p. m.

3.30 resumed.

Int. 12. Dr. Tweddle, in his deposition, describes a method of using this still by admitting the oil continuously in such manner that it dropped

under a series of pipes heated by superheated steam. Have you examined what he said upon this subject sufficiently to understand the manner in which the still operated; and, if so, will you state whether or not, in your judgment, the oil would be more liable to decomposition, and to the formation of lighter oils, instead of those of heavier gravity, than it would be when introduced into the still in a body, so as to surround and cover pipes heated in the manner he described, all other conditions being alike?

Ans. I have examined what he said in regard to that particular manner of running that still, and, in my judgment, that method would
556 be more likely to break up and crack the heavy oils than it would if their steam-pipes were covered with the same oil, heated in the same manner.

Int. 13. Why do you think so?

Ans. Because in allowing the oil to drip over the pipes, parts of the surface would undoubtedly be bare, or nearly so, a portion of the time, and become heated above to the point necessary for distillation, and then a first portion of the oil would drop upon the surface thus heated, and be decomposed by the high heat to which it would be submitted.

Int. 14. Will you look at the patent of Dr. Tweddle to which I have referred, dated Feb. 15, 1870, and state whether or not you find described therein a method of distilling oil, and differing from that which is described in the passages I have quoted, and which produces an oil denominated in the patent "neutral topaz oil;" and, if so, state in what manner the oil is introduced into the still for the production of that neutral topaz-oil, whether in a mass or continuously, in such manner as to drop upon and flow over heated pipes, in the manner described by the doctor for using the cast-iron still?

Ans. I find in the method described in this patent for the production of neutral topaz oil, that the oil is introduced in a mass and distilled fractionally in a similar manner to the ordinary distillation, with the exception of being in a partial vacuum, and with the use of steam in the still, the fractions being taken off the same as in ordinary distillation where those appliances are not used.

Int. 15. Will you look at the answer given by Dr. Tweddle in reply to direct interrogatory 222, and state how you understand that the oil was introduced into the cast-iron still, when used in the manner there described, both when producing illuminating oil and when, as the doctor says, he produced neutral topaz oil from the residuum remaining after the distillation of the illuminating oil?

Ans. I understand that in producing the illuminating oil he run in the crude continuously, and allowed it to run over the surface of the heated steam-pipes down into the bottom of the still, in the receiver below it; and that in producing paraffine or neutral topaz oil, as he claimed, the supply of crude oil was shut off and this residue from the receiver was returned upon the same pipes, heated in the same manner.

Int. 16. State whether or not in your judgment, such a residuum
557 as that described by the doctor could have been distilled in the manner he described, so as to produce heavy paraffine oils alone; and, if not, state what other productions would have been produced, what their character would have been and how they would have affected, if at all, the heavy oils which were distilled over.

Ans. In my judgment the residue he describes could not be distilled in that manner so as to produce heavy oils alone, but there would be produced, at the same time, a quantity of light-gravity oil and gas, and a residue containing coke, or fixed carbonaceous products; and the light

oils so produced would injure the heavy oil as a lubricator if condensed with it.

Int. 17. What are your reasons for this judgment?

Ans. The surfaces of the pipe being bare, or nearly so, would become heated so as to decompose the oils when coming in contact with them when so heated.

Int. 18. What would be the character of these lighter oils as to their odor and the facility with which they would evaporate, as compared with the heavy oils?

Ans. They would be similar in these respects to ordinary cracked oil, if separated from the heavy oil, which must be distilled at the same time, when operating in this manner.

Int. 19. If the steam which came from the superheater for supplying the heat required for distillation, in the manner described by the doctor, were so hot as to heat the pipes through which it entered the still to a red heat, at or near the place of entrance, what temperature would you expect to find in the pipes themselves within the still, when the oil was dripping over them in the manner described by the doctor, as compared with the boiling point of such residuum oils as those referred to in the answer I have called your attention to, direct interrogatory 222?

Ans. The temperature of the interior of the pipes within the still would be higher than the boiling-point of this residuum oil.

Int. 20. What would you judge the temperature of the exterior of said pipes to be, under the case supposed, as compared with what it would be if the pipes were covered by a mass of oil?

Ans. The temperature of the exterior of the pipes would be uneven when used in this manner. Whereas, if completely immersed in
558 the oil, the entire surface would be of one or very nearly one uniform temperature. In case the oil were run over, as described in answer to 222, the temperature could be higher than when completely immersed in the oil.

Int. 21. In which of these two cases would such decomposition most readily take place as to produce the lighter oils you have spoken of above, along with the heavier oils?

Ans. In the case where the oil was run continuously over the pipe.

Int. 22. Refer again to the patent of Dr. Tweddle, to which I have called your attention, and state in this connection whether you understand the method he there describes for introducing the oils, to be one where the tendency to the production of lighter oils would be less than when the distillation was conducted by allowing the oils to flow over into the pipes, in the manner described by the doctor in answer to direct interrogatory 222.

Ans. I do consider the tendency to be to produce lighter oils, in less quantity, than in the method described in answer to interrogatory 222.

Int. 23. Have you examined the patent granted to Dr. Tweddle, dated December 10, 1867, No. 72126? and, if so, will you state whether you understand the construction and method of using the stills therein described?

Ans. I have examined it, and believe I understand the construction and method of using the still described therein.

Int. 24. Will you also examine Dr. Tweddle's answer to 129 and 130 direct interrogatories, and the model there referred to, and state whether you understand the stills there described and the method of using them; and whether or not they are substantially like what is described in the patent I last referred to?

Ans. I have examined the model and patent, and also the answers to

interrogatories 129 and 130, and consider the still and the method of using it described in those answers to be essentially the same as that described in the patent.

Int. 25. If the stills described in the answers last referred to differ from the cast-iron still before referred to, in respect to the conditions affecting the cracking of oil and the production of the light oils instead of the heavy oils, will you state in what respect they differ, and in which you find the conditions most favorable for the cracking and decomposition of heavy oils into light oils?

559 Ans. The stills described in the answers of Dr. Tweddle referred to have a less capacity for cracking, in proportion to its distilling capacity, than the cast-iron still previously described; they wanting the high dome and large vapor-space of the cast-iron still.

Int. 26. Have you seen samples of neutral topaz oil produced by Dr. Tweddle, or sold by the defendants in this case?

Ans. I have seen samples said to be Tweddle's neutral topaz oil, sold by the defendants in this case.

Int. 27. And did you find such neutral topaz oil to contain the light oils produced in the cracking process which you have spoken of, in distinction to the heavy oils you have spoken of obtained in distilling petroleum?

Ans. I did not find the neutral topaz oil to contain those oils produced by cracking, in any considerable quantity.

Int. 28. State whether or not it would, in your judgment, be practicable when using the cast-iron stills described by the doctor in the manner described by him in his deposition, and with the material described by him, to produce a heavy oil free from the lighter, volatile oils, and like the samples of neutral topaz oil, which you examined.

Ans. I do not consider it to be practicable or possible to produce an oil from the cast-iron still in the manner described, like the samples of neutral topaz oil that I examined, without some auxiliary process not involved in any description of the use of the cast-iron still.

Int. 29. Have you ever examined Mr. Merrill's patent on which this suit is brought?

Ans. I have.

Int. 30. Did you ever make the invention described in it?

(Objected to.)

Ans. I never did.

Adjourned to 10.30, 29th February.

Resumed.

And in answer to cross-interrogatories propounded by Causten Browne, esq., counsel for respondents, deponent saith as follows, viz:

FEBRUARY 29, 1872.

Cross-int. 1. (De bene esse.) You say you never made the invention described in the Merrill patent on which this suit is brought.

560 When you were examined before, as a witness for complainant, you said, in reply to the question whether, as a person skilled in the manufacture of oils, you regarded the production of the Merrill oil as an important improvement in the art (int. 74,) as follows: "I do in several points. First, it accomplishes the removal of the volatile bodies, which I had sought in vain to remove. It also deodorized the oil as well as very greatly increased the quantity that could be made from the

crude oil used." Is the deodorizing of the oil accomplished by the removal of the volatile bodies here mentioned?

Ans. It is; though that was not one of the objects I had in view in attempting to remove the volatile bodies at that time.

Cross-int. 2. (De bene esse.) State how you know that the Merrill improvement, so-called, "greatly increased the quantity that could be made from the crude oil used,"—whether from actual observation of the workings of the Merrill process, or by the report of Mr. Merrill, or by scientific deduction from what you personally knew upon the subject.

Ans. By the investigations upon the oil so produced, and from scientific deduction made from what I already knew.

Cross-int. 3. (De bene esse.) By "oil so produced," do you mean oil which you produced, or which was produced by Merrill or his company?

Ans. I mean the oils produced by the company of which Mr. Merrill is superintendent.

Cross-int. 4. (De bene.) What were the oils so produced which you so investigated?

Ans. I am not positive as to the brand upon the packages, but think it was "Merrill's improved deodorized oil," or something similar to it.

Cross-int. 5. (De bene.) Did you receive more than one such package?

Ans. I have examined a great number of specimens. I never attempted to procure but one sample, but have examined a number of different samples.

Cross-int. 6. (De bene.) I refer to the investigation that you made of the oil, as testified above. In what did that investigation consist, and did you make it upon more than one quantity of oil?

Ans. The investigation consisted of a thorough examination
561 of the oil, as regards color, gravity, odor, boiling-point, and amount of volatile matter contained therein. A full investigation of this kind was only made upon one sample or lot of Merrill's oil; but partial examinations have been made by me from time to time upon quite a large number of different samplies; just how many I cannot state.

Cross-int. 7. (De bene.) How did you obtain the lot upon which you made the full investigation you speak of?

Ans. From Mr. Merrill direct.

Cross-int. 8. (De bene.) Will you state how your investigation of this lot of the Merrill deodorized oil showed you that his improvement had "greatly increased the quantity that could be made from the crude oil used?"

Ans. By showing that an oil of a higher boiling-point, as compared with its gravity, was obtained than by any of the ordinary processes; and as the boiling-point somewhat corresponded with the gravity of the oils previously known, it was found necessary to lower the gravity at the same time *reducing the gravity at the same time* the boiling-point was lowered. Also, by deduction, I inferred that the removal of light, thin, volatile oils from comparatively fixed and viscid oils would allow the use of oils for lubricating purposes that were not sufficiently viscid and oleaginous to be used as lubricators when mixed with the thin volatile oils.

Cross-int. 9. (De bene.) You say that you examined the Merrill oil in regard to the amount of volatile matter contained therein. How did you ascertain that amount?

Ans. By careful fractional distillation.

Cross-int. 10. (De bene.) State how you conducted that distillation.

Ans. A carefully measured quantity was introduced into a tubulated glass retort, a thermometer inserted with its bulk immersed in the oil, carefully regulated fire heat applied, the oil distilled below certain temperatures was carefully observed and recorded; the whole quantity removed below six hundred degrees F., together with the boiling-points being examined and compared with the quantity so obtained from other oils.

Cross-int. 11. (De bene.) Will you go a little more into detail as to that part of your demonstration which consisted in noting the oil distilled below certain temperatures?

562 Ans. I could hardly, without my minutes, go fully into those details. I can, however, give you a general idea of it. After applying the heat to the retort containing the oil, the temperature at which vapor was formed in such quantities as to condense upon the sides and top of the retort above the surface of the oil was first observed and recorded; next the boiling-point, a point at which distillation fairly commenced; next, the point at which full and rapid ebullition took place; and lastly, the distillation was stopped at six hundred degrees F., the quantity of distillate determined, as well as the character of the residue remaining in the retort and any other points regarding discolorization of the retort above the surface of the oil was noted so as to compare with other distillations made in the same manner.

Cross-int. 12. (De bene.) When was this investigation made?

Ans. During the summer of 1870.

Cross-int. 13. (De bene.) What other oils did you subject to a like fractional distillation and to the like observations?

Ans. Tweddle's neutral topaz oil; two or three samples of different Boston manufactories; one or more samples from New York; one or more from Cleveland; one, at least from England, and one manufactured by myself at the Portland Kerosene Works; in all, eight or nine.

Cross-int. 14. (De bene.) State, as far as you can from memory, the names of manufacturers of the several oils named in your last answer.

Ans. H. W. C. Tweddle, of the neutral topaz oil; the Portland Kerosene Oil Company, of Portland; the Downer Kerosene Oil Company, of Boston; Lincoln's oil, by a firm in which his name occurs, also of Boston. I can't give the names of any of the others, as they are parties with whom I never had any business, and can't recollect their names. I can give them from my minutes, which are not here.

Cross-int. 15. (De bene.) Did you receive these oils, except the Portland oil, from Mr. Merrill?

Ans. I did.

Cross-int. 16. (De bene.) Did you learn from Mr. Merrill, or any member of the Downer Kerosene Oil Company, whether the Merrill oil before you received it, had had any of the lighter oils that it contained removed in any degree, by acid treatment, filtration or any kind of evaporation, after the oil had been taken from the still?

563 Ans. I did not learn that it had had any of the volatile oils removed by any process after it was removed from the still.

Cross-int. 17. (De bene.) At what prices, wholesale, did the Portland Company sell their paraffine lubricating oil in 1868, 1869, and 1870?

Ans. My impression is from forty to fifty cents.

Cross-int. 18. (De bene.) Do you know the friction-test instrument, called McNaught's?

Ans. I do.

Cross-int. 19. (De bene.) Is it to be bought in this country, that you know of?

Ans. Not that I am aware of.

Cross-int. 20. (De bene.) Do you know of any good friction-test instrument that is to be bought in this country?

Ans. I do not as a regular article of manufacture.

Cross-int. 21. In answer to direct interrogatory 3, after describing the process of distilling oil from petroleum, you close by saying "the oil is cracked." What do you understand to be the meaning of the word „cracked," in that connection?

Ans. The word in that connection is used by oil-refiners to express the changing or heating up of a heavy, high-boiling-point oil, and the production of a lighter and lower-boiling-point oil from the same.

Cross-int. 22. You have stated the result of the cracking. What I desire to know is, what is the nature of the physical change, if any, produced on the oil under treatment, which you denominate as "cracking?"

Ans. It is essentially a chemical change, to a certain extent of its composition, but more particularly as regards color, mobility and volatility.

Cross-int. 23. How does it differ, if at all, from the change produced in the distillation of oil in the manner and for the purpose referred to in your 3d direct answer, during the first stages of distillation?

Ans. In ordinary distillation, or the distillation referred to in the first part of the answer above referred to, the object accomplished, or sought to be accomplished, is simply the removal of a volatile body from a fixed or less volatile body without change with the physical characters of the body so removed; whereas, in the distillation known
564 as cracking, the object sought and accomplished according to the perfection of the operation, is the changing of the physical character of the body or bodies so distilled.

Cross-int. 24. Commencing with crude petroleum and an ordinary fire-heated still, such as is in general use, how far can the process of distillation be carried without cracking; and with what result or results as to the products.

Ans. If the petroleum is of the ordinary light gravity from Oil Creek, Penn., from sixty-five to seventy-five per cent. will readily distil without any physical change of the bodies distilled. Of the residue left in the still, the amount that is changed in its physical character depends very largely upon the manner of conducting the distillation and the form and arrangement of the different parts of the still.

Cross-int. 25. State the character as to color, odor, and gravity of such products being distilled, and of the residuum, supposing the distillation to be carried on under the conditions referred to in the 34th cross-interrogatory, and as far as it can be carried without cracking.

Ans. The first run of the still, or first distilled, consists of a very volatile and mobile, colorless liquid, known under various names as naphtha, benzine, gasoline, etc.; the distillate gradually increasing in gravity and boiling-point until its boiling-point, or point of vaporization, is too high for the distillate to ignite upon the surface at ordinary temperatures. The igniting-point gradually increases with the boiling-point, while the color, if the distillation be carefully conducted, remains the same until the point is reached at which cracking or change takes place, when the distillate will be found to be discolored. The odors of all the distillates so obtained are more or less offensive. The residue remaining in the still will be of a dark green, a brownish green, a black

or brownish black, according to the nature of the petroleum distilled and the care with which it has been distilled, as well as the arrangement of the still with regard to the application of the heat thereto. The gravity of all the distillates, from the commencement of the distillation until the point of cracking is reached, is gradually increased.

Cross-int. 26. What, in degrees Beaumé, would be the gravity of the last distillate referred to in your last answer, and what of the residuum?

565 Ans. From forty to forty-five degrees gravity of distillate. From twenty-five to thirty-five degrees of the residuum.

Cross-int. 27. You have stated that the odors of the distillates so obtained are all more or less offensive. Please describe their odor more particularly, and compare it also, if you please, with the odor of crude petroleum.

Ans. The odor of the distillate up to the point at which the distillation has been described as stopping is not essentially different from that of crude petroleum; perhaps not quite as pungent, if a small part of the first distillate be expected.

Cross-int. 28. You have spoken, in your answer to 8th direct interrogatory, of the deposition on the top and sides of the still of carbonaceous matter, and referred, also, in the latter part of that answer, to a greater proportionate deposit. Please describe more fully the character of these deposits and where found in the still.

Ans. The deposit of carbonaceous matter taking place from the vapor above the surface of the liquid oil and collecting upon the sides and top, and oftentimes in the pipes leading from the top of the still, is usually of a light feathery character, often not unlike in character a deposit of lampblack; but when a still is run continuously—by which I mean successive runs for a length of time—fresh particles of carbon deposit between the particles first deposited until occasionally a deposit will be found in contact with the sides and top of the still hard and compact. The larger part of the carbon, however, is deposited from the oil below the surface, at first in loose particles floating through the liquid oil, a small portion adhering to the bottom and sides, which adhering portion is gradually augmented in quantity until nothing but solid carbon remains of the form of ordinary black coke.

Cross-int. 29. Is not the deposit of carbonaceous matter referred to by you increased in rapidity of deposition, and in solidity and hardness, by the intensity of the heat applied to the oil?

Ans. If the heat applied to the oil is all below the surface of the oil, with a free chance for the vapors formed to escape, the amount of carbon deposited in a given time is increased by an increased degree of heat, but not in proportion to the amount of oil distilled.

Cross-int. 30. To what do you attribute the deposits of carbonaceous matter above and below the surface of the oil being distilled?

566 Ans. I attribute it to the chemical change taking place in the oil, whereby the hydrogen combines with the carbon so as to take a less amount of the carbon than existed in the original oil, the difference being deposited in the form of coke or other matter described. This chemical change is the cracking process.

Cross-int. 31. What experience have you had in the practical distillation of petroleum with a vacuum or partial vacuum in the condenser or still?

Ans. I have had none.

Adjourned to 3.30 p. m.

3.30 p. m., 29 Feb. Resumed:

Cross-int. 32. (De bene.) If you have here now your minutes, or a copy of them, showing your investigation of the Merrill and other oils mentioned in the early part of your cross-examination, will you give the names of the oils which you subjected to those experiments, together with the Merrill oil?

Ans. I have a copy of the report of the series of my investigations. I give them as follows:

Merrill's deodorized heavy hydrocarbon oil.
Reed's paraffine oil, Boston.
Richardson's paraffine oil, New York City.
David Watson's paraffine oil, Bathgate, Scotland.
Neutral topaz oil, H. W. C. Tweddle, Pittsburg, Penn.
Merriam & Morgan's paraffine oil, Cleveland, Ohio.
Libby & Clark's paraffine oil, New York City.
Wm. Lincoln's paraffine oil, Boston.
Portland machinery oil.

The latter was the oil made by the Portland Kerosine Oil Company under my superintendence.

Cross-int. 33. (De bene.) What proportion of distillate did you get from Merrill's oil, Tweddle's oil, and the Portland Co.'s oil, respectively?

Ans. I find, on reference to my minutes, that I got five-tenths of one per cent. from Merrill's oil; four per cent. from Tweddle's; four and one-tenth per cent. from the Portland Kerosene Oil Co.'s oil.

Cross-int. 34. (De bene.) Was this distillate the condensed vapor
567 of the light oils removed from the three oils mentioned by the distillation?

Ans. It was the condensed vapor of the first fraction of distillation in each case.

Cross-int. 35. (De bene.) Did you condense the vapors of any distillation subsequent to that fraction?

Ans. I did not.

Direct resumed:

Int. 1. Suppose you take two stills, constructed exactly alike, and supply each with the same quantity of the same crude oil, and apply to one of them a high heat, so as to produce what you would call a rapid distillation, and to the other a lower degree of heat, what difference, if any, would there be in the products which you obtained in the respective stills?

Ans. The distillates from each, to commence with, would be alike, essentially, until the point was reached at which cracking would take place, when that to which a high or rapid heat was applied would gradually and constantly increase in density or viscidity as well as color, until nothing but coke remained in the still, while that to which a moderate or low heat was applied would continue to run nearly colorless oil, together with considerable gas, this colorless or nearly colorless oil having a strong odor, different from the distillate previously obtained from the same still, and the distillate rapidly changing in color from exposure. This distillate, by carefully regulating the heat, would maintain its essential characters until nothing but coke remained in the still, the amount of such coke being very much in excess of that left in the one to which rapid and strong heat was applied.

Int. 2. In my last question I assumed two stills to be constructed alike. I wish you now to assume that one still is higher than the other—say twice as high—and that, in all other respects, they are alike, and

that they be charged with the same quantity of the same crude oil, and that heat be applied to them in precisely the same manner and degree, would there be any difference in the products obtained under these conditions; and, if so, what?

Ans. If the heat applied to the two stills in such degree as to cause a rapid distillation from the small one, kept up so as to maintain
568 the distillation in the same manner as that described in a previous answer as having high heat applied to it, the distillate from that still would be the same as that described in the last answer, while that from the still of double height would maintain the same essential character until it had reached the point at which cracking takes place, when, owing to the large vapor space and the height of the dome of the still above the surface of the oil, the heavier oil would condense upon the side of the still, and throughout the top of the still in the form of fog or mist. The oil thus condensed descending through the vapor nearer the surface of the oil, which would be hotter than the oil thus condensed, and the heat of the vapor greater than the boiling-point of the oil so condensed, the oil would be redistilled by that vapor, depositing carbon, which would adhere to the sides of the still, when in contact with them, while the vapors thus generated would be vapors of an oil having a lower boiling-point than that first condensed, consequently rising higher in the still and into a cooler portion thereof. The vapors of those oils having a low boiling-point having a less specific gravity than those having a high boiling-point, as well as the condensation of the vapors of those oils having a high boiling-point, would only allow the vapors of the low-boiling-point oils to reach the top of the still and to pass out into the condenser, thereby cracking and essentially changing the character of the distillate obtained from the large still, although the amount of vapor raised from the surface of the oil would be alike in quantity in the two stills.

Int. 3. Would there be any difference in the time required to distil off the charges of crude oil in the case assumed in the last question; and, if so, which still would require the longer time, and for what reason?

Ans. There would be a great difference in the time required, the larger still requiring a longer time for the reason that that portion of the oil that condenses in the top of the large still and returns back into it, would have to be again redistilled, while that in the small still would pass out of the condenser and appear at once as distillate, while in the large still only that which by repeated redistillations had been cracked and changed until it could reach the top of the still could pass out.

Int. 4. What do you understand the reason to be of the cracking of the heavy oils into light oils when the distillation takes place with
569 moderate heat in a high still, or in any other case where it does take place?

Ans. The different oils associated in crude petroleum not only have different boiling-points, but also differ in their degrees of volatility without change; one portion volatilizing perfectly without change, while another changes to a greater or less extent whenever it is thus volatilized. In the case of these having high boiling-points, and a considerable tendency to change, (as all those oils which have high boiling-points have,) the vapors condense in the top of the still and redistil in the manner described in the previous question, until they are converted into oils, having little or no tendency to change in that manner.

Int. 5. At what points of temperature respectively did the distillation of vapor commence in the Merrill oil, Tweddle oil, and Portland oils,

respectively, which were the subjects of the experiments referred to in your cross-examination?

(Objected to.)

Ans. Merrill's oil commenced at six hundred degrees; Tweddle's topaz oil at five hundred and fifteen degrees; Portland oil at four hundred and fifty-five degrees.

Int. 6. What were the gravities of these oils before they were subjected to the experiments?

(Objected to.)

Ans. Merrill's oil was at 60 F.—30 3-4° Beaumé.
Tweddle's " " " 35° Beaumé.
Portland Manf. oil " 27¼° Beaumé.

Int. 7. How were the gravities of the residuums effected by distilling off the quantities which you have mentioned in your cross-examination?

(Objected to.)

Ans. The gravity of the residue was raised in all cases.

Int. 8. Relatively to each other, then, how much were they raised?

(Objected to.)

Ans. Merrill's oil was raised sixteen one-hundredths of one degree; Tweddle's, twenty-six one-hundredths; Portland machinery-oil, sixty-one hundredths of one degree.

570 Int. 9. What do these conditions of gravity, and the points at which distillation commenced indicate as to the character of what was distilled over, compared to the oil which was the subject of distillation?

(Objected to.)

Ans. They indicate that those oils commencing to distil over at a high temperature are more nearly like the product distilled. Or, in other words, those having high boiling-points did not contain any volatile oils, or, if any, but very little, ready formed.

Cross-examination resumed:

Cross-int. 1. (De bene.) And what point of temperature, respectively did the three oils last referred to, yield vapors which condensed on the sides of the retort?

Ans. Merrill's oil, at 330° F.
Tweddle's " 320° F.
Portland " 330° F.

Cross-int. 2. (De bene.) What do you mean by your last answer (direct by volatile oils "ready formed?"

Ans. I meant oils ready formed, of low boiling-point, as compared with the mass of the oil composing the sample. That is, by ready-formed volatile oils, I meant oils having a low boiling-point, but mixed and held in solution by a large quantity of oils having a high boiling-point, in distinction from oils obtained from those having a high boiling-point by distillation, and changed at the same time to those of low boiling-point, and differing from the oil from which they were derived.

Cross-int. 3. Then you mean by ready-formed volatile oils, oils which are distilled in vapor without undergoing cracking?

Ans. I do.

WM. ATWOOD.

571 *Deposition of Charles Toppan, taken before H. Farnam Smith, esq., special examiner, Friday, March* 1, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Charles Toppan; age, forty-eight years. I reside in Wakefield, Mass., and I am a trader.

Int. 2. Were you, during the years 1868 and 1869, connected with the Lightfoot Currying Oil Company? If so, in what capacity, and what were you duties?

Ans. I was, as superintendent; and I attended to the purchases and sales of the company.

Int. 3. What was it which you purchased and sold?

Ans. Currying-oils manufactured from petroleum.

Int. 4. How did you designate the oils which you sold?

Ans. In 1868, to the fall of that year, they went as A, as a stuffing-oil, AX as a finishing oil, AAX for oiling off.

Int. 5. Have you any samples here of the oils which in 1868 you sold under those designations? If so, will you produce them as exhibits, pointing out to which class each belongs?

Ans. The bottle marked "Exhibit No. 103" is the A stuffing oil. The bottle marked "Exhibit No. 104" is the AX finishing oil. The bottle marked "Exhibit No. 105" is the AAX for oiling off.

Int. 6. State whether or not these samples are oils which were made in 1868, or about that time, and whether they have undergone any change in keeping; and if so, what?

Ans. These were made about that time, and have turned a Little darker in color than they originally were. The odor is more pungent; it is not so sweet. It is turned a little rancid with age.

Int. 7. Who manufactured these oils?

Ans. Messrs. Seccomb, Kehew & Thayer.

Int. 8. Who were the principal manufacturers from whom the Lightfoot company obtained their oils during the year 1868?

572 Ans. Messrs. Seccomb, Kehew & Thayer manufactured exclusively them for till about September, 1868, and we purchased exclusively of them. About this time we began to purchase a stuffing oil of Dr. Tweddle, which we called "the improved stuffing oil."

Int. 9. In the use of the oils manufactured by Seccomb, Kehew & Thayer, was there objection found to them on account of their odor, and on account of the presence of crystallizable paraffine?

Ans. There always was a serious objection to the use of them on account of the A stuffing-oil crystallizing on the bottom. The odor was also always another very serious objection. After the leather was finished, it left an odor which was injurious to the sale of the manufactured stock.

Int. 10. Did this objectionable odor exist in each of the three kinds of oil?

Ans. It did.

Int. 11. Will you state whether or not, in the early part of 1868, or in the summer of that year, an oil was put upon the market by a company in Rochester, to be used for currying purposes? If so, will you state what kind of an oil it was, and whether it was used for a stuffing or a finishing oil?

(Objected to.)

Ans. There was. It was called the "Vacuum stuffing oil," and sold by the Vacuum Oil Company, of Rochester. It was in the early part of the year. It was a vacuum distilled oil, and used exclusively for stuffing.

Int. 12. What was its color and odor?

Ans. Black; very sweet in odor.

Int. 13. Will you look at the sample of oil now shown you, marked

"Exhibit 106," and state how it compares with the oil sold in 1868, by that Rochester company?

Ans. I should say that it compared very favorably. It has the same buttery appearance. It has also the peculiar taste of "vacuum-oil."

Int. 14. As to its color and gravity, or consistency, how is it?

Ans. I should say it was a similar thing.

Int. 15. State whether or not this oil was open to the same objections in its use, which you have spoken of as appertaining to the stuffing
573 oil which your company was then selling, as to crystallizing upon the leather, and as to odor.

Ans. It was free from all those objections, had no crystals, and in stuffing the tallow removed what little odor it had.

Int. 16. State whether or not, in consequence of the introduction of this Rochester oil in the market, your company made efforts to procure an oil similar to that, or at all events free from the objections which you have mentioned as to your own oil.

Ans. The Rochester had nearly driven our A stuffing out of use. Not being able to get the Rochester oil, set us to hunting for a substitute.

Int. 17. State whether or not in hunting for a substitute, you visited Pittsburg; and, if so, when you made such visit.

Ans. I heard of Dr. Tweddle in New York, made a trip to Pittsburg; arrived there about the 3d day of August, 1868.

Int. 18. State whether or not you visited Dr. Tweddle's "Eclipse Refinery" near Sharpsburg, and, if so, whom you saw at your first visit.

Ans. My first visit at his "Eclipse Works," Sharpsburg bridge, was the day following my arrival in Pittsburg. I saw his foreman, or a man who represented himself as his foreman.

Int. 19. Can you give the name of this man?

Ans. I cannot.

Int. 20. State whether or not you carried with you at this first visit to the refinery any samples of oil, and, if so, what kinds of oil they were.

Ans. I carried up a sample of our A stuffing, a sample of the AX finishing, and of the AAX for oiling off, and a sample of the Rochester vacuum oil.

Int. 21. Was Dr. Tweddle at his refinery at the time of that visit?

Ans. I did not see him. The foreman said he was down at Smith's Ferry purchasing oil.

Int. 22. State whether or not you explained to the foreman the purpose of your visit, and showed him the samples of oil which you carried with you.

(Objected to.)

Ans. I did. I explained to him what I wanted; showed him my samples. He requested me to leave them and call the next day, as he expected the doctor home that night, or in the morning.

574 Int. 23. If the foreman made any statement to you, as to what oils suitable for your purpose the doctor had or had not, or as to the character of such oils as the doctor had, will you state what he said?

(Objected to.)

Ans. He showed me what they were making; stated that they were made by the vacuum process, the same as the Rochester oil. He carried me through the works, and showed me what refined oil that they had on hand.

Int. 24. What kind of oils were they which he showed you?

Ans. He showed me a burning oil and a heavy, dark black oil, very

similar to the Rochester oil. The only difference I could see about it, it didn't chill up so readily. He called it his "railroad lubricator."

Int. 25. State whether or not he showed you any light-colored oils, suitable to be used for finishing or oiling off with.

Ans. He showed me nothing of the kind.

Int. 26. State whether or not you said anything to him about wishing to obtain such light-colored oils, as well as the stuffing oil.

(Objected to.)

Ans. We talked it over. I stated that if we could get a finishing or an oiling-off oil as free from odor and as free from acids as the Rochester oil, and have it light-colored, to match our AX and AAX, it was just what the Lightfoot company were after.

Int. 27. If he said anything in reply to these statements of yours, state what it was.

(Objected to.)

Ans. He said he had no doubt they could make the vacuum oil, the black oil, but the finishing oils, the light-colored oils, they were not making.

Int. 28. You said that the foreman requested you to leave your samples with him. State whether or not you did so.

Ans. I left them with him.

Int. 29. What quantity of the dark-colored oil which he showed you did you see while there?

Ans. He told me they had about fifteen hundred barrels on hand.

(Objected to.)

He showed me a small sample.

Int. 30. State whether or not you took from the foreman a sample of that dark-colored oil.

575 Ans. He gave me a sample.

Int. 31. Have you got that sample now? If so, will you produce it as an exhibit in this case?

(Objected to.)

Ans. (The witness produced the bottle labelled "Exhibit No. 107," and said,) "That is the sample."

Int. 32. State whether or not the sample has undergone any sensible change in its character or its appearance since it has been in your possession.

Ans. It has changed in odor. The odor is stronger than it originally was.

Int. 33. State whether or not, in compliance with the foreman's invitation, you visited Dr. Tweddle's refinery the next day; and if so, whom you saw there.

Ans. I called the next day and met Dr. Tweddle.

Int. 34. State whether or not you explained to him the object of your visit; and, if so, what passed between you.

Ans. I explained to the doctor the object of my visit. I wished to procure an oil as a substitute for the "Rochester vacuum oil" for the Lightfoot Carrying Oil Company. He told me the Rochester folks were manufacturing under his process; that they were infringing his patents; that if they had had any bottom he would have stopped them a long time ago; that he could manufacture the same oil for us, if we would furnish him with samples showing just what we wanted. He also looked over the finishing oils. He inquired about them particularly, and said he thought he could make them also. I asked the foreman for my samples which I left there the day before. He brought them out, and they were about half gone out of each bottle. The doctor told me that he

had been examining them, and had taken out about half out of each one. He carried me through his works, showed them to me, told me that his great object was to get burning oil distilled by the vacuum process, and said his great drawback was the per cent. of heavy oil which he had left, which he had only a limited market for. He said if we could use his dark heavy oil it would be a great relief to him, and just what he would like to accomplish. He was very desirous to make an attempt to furnish the oil for the Lightfoot company. I spent two
576 or three hours with him that day. I met him the next day in at his agent's in Pittsburg and had another talk with him, and left it with the understanding that he was to make us a sample of oil. The doctor stated distinctly to me that he was making no light-colored oils, that he could substitute for our finishing and oiling-off oils, but he thought, by a little management, he might produce something that would serve us better than the oils we were then using. He called at the hotel that afternoon and requested me to give him the balance of my samples of the light colored finishing oils, and wished me to send three or four gallons of the Rochester vacuum oil.

Int. 35. State whether or not in either of these interviews with the doctor you explained to him the objections which were found to exist to the use of your light-colored oils in respect to the odor and the importance or desirableness of obtaining oils free from such odor.

Ans. I can state that I explained the difference between the vacuum distilled oils and our stuffing oil, positively; the advantages of the vacuum-distilled oil over our A oil; and, no doubt, explained the same objections that we had to the use of the finishing oils. My object was to get the oil shown in Exhibit No. 106, and in doing this I explained to him the objections to our A stuffing oil. Our finishing oils having the same objections that the A has in odor, and having been treated with acids, I undoubtedly explained the whole thing to him.

Int. 36. State whether or not you said anything to him at any of those interviews about the demand there was, or there might be, for these several kinds of oils, to be used for currying purposes; and what, if anything, the doctor said upon the subject of supplying such demand.

Ans. I told the doctor as near as I could what the consumption was, and he represented to me that he could turn out an unlimited quantity of it, something like a thousand barrels a day, if it was necessary.

Int. 37. State whether or not you afterwards sent to the doctor, and, if so, how soon, a sample of the Rochester vacuum oil, and how much; and whether at any time after that you sent him a sample of the oil made by Seccomb, Kehew & Thayer, either for finishing or oiling off; and if so, when, and what quantity?

Ans. On getting home, some time during August, I had sent to him a three or five gallon can of the Rochester oil as a sample. Some
577 time after that, a few weeks, by the request of Dr. Tweddle, I had Seccomb, Kehew & Thayer send to him a barre of the finishing oil, AAX. I couldn't give the exact date of sending this.

Int. 38. Will you look at a letter marked Exhibit No. 80, and state whether or not you received that letter from Dr. Tweddle, on or about the time it bears date?

Ans. I did.

Int. 39. In this letter I find the following: "Within a few days I will forward to Mr. Bartlett some light-colored oil, which I think will be admirably adapted to the purposes of the Lightfoot company. He will

submit it to your inspection, and if it suits, I will manufacture it in any quantity which you desire." State what Mr. Bartlett you understood this to be, and whether or not he did afterwards hand you any samples.

Ans. I understood it to be Mr. Bartlett, Dr. Tweddle's agent in Boston, and he afterwards handed me two samples.

(Adjourned.)

SATURDAY, *March* 2, 1872.

Int. 40. If you have in your possession now the two samples which you received from Mr. Bartlett soon after you received Dr. Tweddle's letter of August 20, 1868, will you produce them as exhibits?

Ans. I have, and produce the two bottles labelled "Exhibits Nos. 108 and 109" as the samples so received by me.

Int. 41. State whether or not these oils on examination proved to be satisfactory for use as your AX and AAX oils.

Ans. On examining them we found they were not up to our standard, and couldn't be used.

Int. 42. You spoke of sending to the doctor a barrel of the finishing AAX oil. Can you state whether this was sent before or after you received these samples from Mr. Bartlett?

Ans. I can't say positively whether it was before or after; but I think it was quite a little while after I received them.

Int. 43. Did you or the Lightfoot company purchase of the doctor any dark oil for stuffing; and, if so, when was the purchase made and what quantity was purchased?

578 Ans. The company purchased from Dr. Tweddle during the months of August, September, and October, 1868, about a thousand barrels of his heavy, dark oil.

Int. 44. Do you remember what price the company paid for it?

Ans. I am quite sure it was twenty-five cents a gallon.

Int. 45. Have you a sample of that oil? If so, will you produce it as an exhibit, and state how it differs, if at all, from the railroad oil which the doctor had on hand when you first visited his refinery?

Ans. I have. This is the sample labelled "Exhibit No. 110." The railroad oil was stronger in odor and was lower in gravity than what we call the vacuum stuffing oil shown in the exhibit. The oil in the exhibit has a buttery or salvey appearance, and in making a stuffing it takes a much less per cent. of tallow to bring the stuffing to the right consistency than the railroad oil.

Int. 46. Is this the kind of oil which you said your company called "Improved stuffing oil?"

Ans. It is.

Int. 47. You said that the barrel of your AAX finishing oil, made by Seccomb, Kehew & Thayer, was sent to the doctor, at his request. State, if you know the reasons, why he wished to procure that barrel.

(Objected to.)

Ans. He wished it as a sample, as he was going to try an attempt to make an oil that he could sell from his place as a finishing oil.

Int. 48. Will you state whether or not he did, while you were in communication with him in the fall of 1868, produce and show to you any oils suitable for finishing oils?

Ans. He wasn't able to even show us anything that approached in quality or color the oils that we were then selling as a finishing oil—our AAX oil. The doctor was very desirous to do it, but he never accomplished it.

Int. 49. Will you look at two circulars which have been introduced

as exhibits in this case, marked "No. 78 and 79," and state if you have ever seen them before, and, if so, when you first saw them?

Ans. I saw them in the fall of 1868. Dr. Tweddle sent them to me,

Int. 50. Will you state whether or not these circulars were copied in whole or in part from circulars which had previously been
579 issued by the Lightfoot company and which had been furnished to Dr. Tweddle?

Ans. I furnished Dr. Tweddle with copies of our circulars which were in use at that time, the fall of 1868, as requested by him. "Exhibit No. 79," is nearly an exact copy of one of our circulars. He has substituted the word "I," for Lightfoot company. This is about the only variation. "Exhibit 78" is very nearly a copy of our circular, with the exception of the heading.

Int. 51. In these circulars the AX oil for oiling off, and the AAX for finishing, are apparently included among the oils which the doctor offers to curriers for use in their business. State, if you know, how the doctor was to procure those oils for his trade, if he was unable to manufacture them.

Ans. There was a verbal understanding that he was to procure them of Seccomb, Kehew & Thayer.

Int. 52. State, if you know, what the terms of that understanding were, and whether any of those oils were furnished to the doctor under such understanding.

Ans. As I understood it, he was to buy the oils of Seccomb, Kehew & Thayer at the same prices the Lightfoot Currying Oil Company were paying, the doctor to pay his royalty of three cents a gallon to the Lightfoot company. I am very positive that he had one or two lots of oil sent him, but I couldn't give the dates.

Int. 53. Do you know the quantity in those lots, and whether they were sent directly to him or not, or to other parties named by him?

Ans. I couldn't tell the quantity. The oil was shipped to Dr. Tweddle direct.

Int. 54. Do you know whether any of those oils were sent to any agent of Dr. Tweddle's by his request? If so, to whom they were sent and in what quantities?

Ans. Dr. Tweddle wished one lot of oil to be sent for his agent in Chicago. The agent's name I never knew. The doctor always refused to give the names. I am very sure that it was five barrels of the finishing oils that he wished for his Chicago agent.

Int. 55. State whether or not, during the fall of 1868, Dr. Tweddle visited Boston and Philadelphia one or more times to confer with the officers of the Lightfoot company in respect to making a perma-
580 nent arrangement for the sale of oils under the patents of the Lightfoot company; and, if so, whether or not such negotiations were carried on so far that drafts for an agreement between the parties were prepared, and whether or not any such contracts were finally executed?

Ans. Dr. Tweddle visited Boston once, to my knowledge, in reference to making arrangements for the sale of the Lightfoot oil. The Boston directors told me that he was present at a meeting in Philadelphia for the same purpose. I was not there; agreements were drawn up and submitted to Dr. Tweddle, but they never were signed. The whole thing fell through.

Int. 56. You have spoken of receiving two samples of Dr. Tweddle's oil through Mr. Bartlett. Did you ever receive any other samples from

Mr. Bartlett? If so, will you state when, and under what circumstances?

Ans. I have. I received eight samples from Mr. Bartlett, September 27, 1869. Mr. Bartlett had previously told me that he was to have some samples of oil from the doctor, that he called his "neutral oil," which he could warrant equal to Downer's "neutral oil." Mr. Bartlett explained very fully to me about the oils, and promised to furnish them to me the moment he got them. I told him I wished some samples to send to Europe. There was a party in Liverpool who was purchasing our improved stuffing oil, wished me to send the best thing I could find at the price, that was, a sweet limpid oil. Mr. Bartlett said he had had one lot of oil come along that was of the same kind, but the doctor wrote him that he had improved it very much and would send him some samples to put into the fair, and that he would give me my samples from those cans. He gave them to me on September 27, 1869, and four of these are the samples labelled Exhibits Nos. 111, 112, 113, and 114. The tags now on them, and which have been numbered and endorsed by the commissioner, were on them when they were given to me, and the other marks on three of them are in Mr. Bartlett's handwriting, and on the fourth one in my own handwriting. The other four, which were duplicates of the exhibits, were sent by me to Europe.

Int. 58. How do you fix the time when you received these last samples?

Ans. By a price-list given me at that time, dated and given me by Mr. Bartlett with his own signature.

581 Int. 59. Will you produce that price-list as an exhibit in the case?

Ans. I do, marked "Exhibit No. 115."

Int. 60. You have stated that the first two samples furnished you by Mr. Bartlett in 1868, were not suitable to be used for finishing oils, in place of those made for you by Seccomb, Kehew & Thayer. Will you state how it was in that respect, with the last samples he furnished you, which you have just produced, especially the two marked "Neutral oil?"

Ans. The two samples marked "Neutral oil" are admirably adapted for that purpose. The sample Exhibit No. 114, for a finishing oil, solidifies too quick for that purpose. No. 113 is better adapted for it, but not equal to the two neutral samples.

Int. 61. How long after you received these samples did your concection with the Lightfoot company continue?

Ans. About two months.

Adjourned.

MONDAY, *March* 4, 1872.

Cross-int. 1. In answer to the 16th direct interrogatory, you say, "Not being able to get the Rochester oil, set us to hunting for a substitute." Why were you not able to get the Rochester oil?

Ans. The Lightfoot company and the Rochester company were in dispute as to the validity of the Lightfoot patents. The Lightfoot company had commenced suits against the Rochester company's customers.

Cross-int. 2. Did the Rochester company refuse to sell their stuffing oil to the Lightfoot company?

Ans. Yes, sir.

Cross-int. 3. At any price?

Ans. At market prices; I suppose that was talked at the time. No other price.

Cross-int. 4. Are you able to say what was the highest price you offered them?

Ans. No, sir.

Cross-int. 5. If I understand your answer to the 24th direct interragatory, you mean to say that Dr. Tweddle's railroad lubricator, so called, didn't chill up so readily as the Rochester oil. Do you so mean?

582 Ans. The sample given me by the man who represented himself as the foreman of Dr. Tweddle, I mean, did not chill so readily as the vacuum oil, our stuffiing oil.

Cross-int. 6. Will you read your answer to the 24th direct interrogatory, and tell us whether you mean that what was shown to you as the railroad lubricator didn't chill up so readily as the Rochester oil?

Ans. It did not. That is what I mean.

Cross-int. 7. What made the Rochester chill up?

Ans. I don't know, sir, that I can answer that question.

Cross-int. 8. Do you mean that you haven't sufficient knowledge of the properties and action of such oils to be able to answer?

Ans. I didn't distil the oils. They were represented to me as vacuum-distilled oils. The light oils having been run off, leave a heavy oil that is very sensitive and chills very easily. I won't undertake to go on and explain.

Cross-int. 9. Will you answer my question, or have you answered it as well as you can?

Ans. The large amount of paraffine in it I suppose makes it chill.

Cross-int. 10. Then there was more paraffine in the Rochester oil than there was in the Tweddle's railroad lubricator, I suppose?

Ans. That I can't say.

Cross-int. 11. Why can't you say? Do you not know enough about the nature and operation of oils of this character?

Ans. Not by merely looking at them without their being analyzed. I have never analyzed them or had them analyzed, the two, to compare.

Cross-int. 12. You say that you suppose the Rochester oil chilled because of the large amount of paraffine in it. You also say that the railroad lubricator did not chill so readily. Do you not suppose, from that fact, that it had less paraffine in it than the Rochester oil had?

Ans. It would be all guesswork, unless I had the two samples analyzed.

Cross-int. 13. What makes you suppose that the Rochester oil chilled from the large amount of paraffine in it? What do you know about that? Did you ever analyze that?

Ans. It was so told me by the manufacturer, Mr. Everest. It was always claimed that. I never have analyzed it.

Cross-int. 14. Do you mean that Mr. Everest claimed that there
583 was paraffine in the Rochester oil, and that such paraffine caused it to chill up?

Ans. Mr. Everest always claimed that there was paraffine in his oil, which helped to chill it and make it sensitive to the weather.

Cross-int. 15. How do you know that paraffine helps to chill oil, or make it sensitive to the weather?

Ans. I know the cold weather chills it up. I don't claim to be a professional distiller, or a chemist. I know the practical workings of the oil.

Cross-int. 16. Without analyzing them, I suppose you mean?

Ans. I mean the practical working of the oils in the stuffing and finishing of leather.

Cross-int. 17. It seems, if I understand you, that you were able to ascertain, as a practical man, and without analyzing the Rochester oil, that the large amount of paraffine in it caused it to chill up, but when upon its being stated that the Tweddle railroad lubricator did not chill up so readily, I ask you whether you do not suppose it had less paraffine in it, you answer me that it would be all guesswork without analyzing it. Have you any other answer to make now, or do you leave it there?

(Question objected to, because the witness has not stated that he was able to ascertain, or did ascertain, that the large amount of paraffine in the Rochester oil caused it to chill up, but only that he supposed that to be the fact.)

Ans. I don't know but that the railroad oil has the same amount of paraffine that the stuffing oil has, but by some peculiar treatment it may prevent it from chilling.

Cross-int. 18. Did you ever hear of any treatment for preventing oil from chilling when there was paraffine in it?

Ans. By pressing it in presses, is the only treatment I know of.

Cross-int. 19. Now you say that, for ought you know, the Tweddle railroad lubricator had as much paraffine in it as the Rochester oil, but had been treated so as to prevent it from chilling; and you say that the only treatment you know of for preventing oil from chilling, when there was paraffine in it, was by pressing it out. Now, if you have any reason whatever to give why you believe or suppose that the Tweddle railroad lubricator had as much paraffine in it as the Rochester
584 oil had, in the face of the fact that it did not chill up so readily, I will thank you to state it; and if you have none, please state that.

(Objected to, because the witness has not stated that he believes or supposes that the Tweddle railroad lubricator had as much paraffine in it as the Rochester oil.)

Ans. I have not said that the railroad lubricator had as much paraffine *in* it; not to my knowledge. I know that the stuffing oil chills the quickest.

Cross-int. 20. Were the objections to the last question and to the 17th cross-interrogatory heard by you before you answered those two questions?

Ans. I heard Mr. Smith's objections before answering.

Cross-int. 21. What stuffing oil do your people use now?

Ans. The company is not selling any oil at present.

Cross-int. 22. When you speak of "our stuffing oil" in answer to the 5th cross-interrogatory?

Ans. It is the A oil.

Cross-int. 23. Made by whom?

Ans. Seccomb, Kehew & Thayer.

Cross-int. 24. Do they make vacuum stuffing oil, or did they ever do it?

Ans. I don't know anything about it.

Cross-int. 25. About what?

Ans. Whether they have ever or do make vacuum-distilled oils.

Cross-int. 26. In your answer to the 5th cross-interrogatory you say, "did not chill so readily as the vacuum oil, our stuffing oil." If you did not mean by that that "our stuffing oil" was "vacuum oil," what did you mean?

Ans. I didn't understand the question. I mean that our oil was a vacuum oil.

Cross-int. 27. Who makes it for you, or furnishes it to you?

Ans. I have no connection with the Lightfoot company now, and they are not receiving any oil to the best of my knowledge.

Cross-int. 28. From whom did they receive the last of that stuffing oil which you say was a vacuum oil?

Ans. From Mr. Everest, to the best of my knowledge.

Cross-int. 29. How long ago?

585 Ans. In the fall of 1869.

Cross-int. 30. When did your connection with the Lightfoot Company cease?

Ans. In the fall of 1869.

Cross-int. 31. Have the company done business since?

Ans. They may have done a very little.

Cross-int. 32. What has been your business since you left them in the fall of 1869?

Ans. I have been interested in water-proofing woven fabrics.

Cross-int. 33. While you were with the Lightfoot company did you own any interest in either of the Lightfoot patents?

Ans. I owned some stock in the company. That was all the interest I had.

Cross-int. 34. Did you not tell Dr. Tweddle, when you met him in Pittsburg, in 1868 or 1869, that you owned certain Western territory under the Lightfoot patents?

Ans. I told Dr. Tweddle I had control of the Eastman territory.

Cross-int. 35. How did you have control of it?

Ans. By written agreement with the owners.

Cross-int. 36. Is that agreement still in existence?

Ans. I think it is, but I can't say certainly about it. The time expired. There was a limitation to it.

Cross-int. 37. Have you neither bought nor sold, nor been concerned in buying nor selling, directly or indirectly, in your own name, nor in that of somebody else, any oil for currying purposes since your connection with the Lightfoot company ceased in the fall of 1869?

Ans. I have a patent for filtering vacuum-distilled oils. Parties working under that patent pay me a royalty of so much a gallon, which is the only connection, directly or indirectly, I have in buying oils. I have sold a very little, directly, for one of the factories.

Cross-int. 38. What is the date of your patent?

Ans. February 1, 1870, if I remember right.

Cross-int. 39. Do you hold it as inventor or assignee?

Ans. I hold my interest, one-third, as the inventor.

Cross-int. 40. Who holds the rest, and do they hold it as inventors or as assignees? Give us the whole story.

586 Ans. Moses F. Winn, of Woburn, holds the balance. It was assigned to him.

Cross-int. 61. I understand, then, that the patent was granted to you as inventor, and that you assigned two-thirds of it to him?

Ans. Yes, sir.

Cross-int. 42. You say that your patent is for filtering vacuum-distilled oils. What effect does your filtering process have on a vacuum-distilled oil, and what is the appearance of the oil after this treatment?

Ans. It makes it lighter colored, freer from odor. It congeals quicker.

Cross-int. 43. How much lighter in color?

Ans. It can be graded all the way from nearly white to nearly black, or without removing very little of the color.

Cross-int. 44. What do you filter through by your process?

Ans. Animal charcoal.

Cross-int. 45. Can a heavy oil, as heavy as the vacuum oil to which you apply your process, but produced as the residuum of fire distillation, be treated by your process with like results?

Ans. I have never tried it; I can't say.

Cross-int. 46. Has anybody else tried it that you know of?

Ans. Not that I know of.

Cross-int. 47. Why do you call your patent a patent for filtering vacuum-distilled oils?

Ans. I claim the product of a vacuum distillation in my patents, filtered through animal charcoal or any other suitable filtering substance. That is the pith of the claim.

Cross-int. 48. How do the products of vaccum distillation differ from the products of fire distillation, for the purposes of your filtering invention?

Ans. I have never filtered the products of fire distillation, not to my knowledge, unless we have been deceived by parties selling us the oil. All the oils that I recommend for filtering, or have had anything to do with myself in filtering, have been commercially termed vacuum-distilled oils.

Cross-int. 49. Well, what is the difference between the products of the two modes of distillation for your purposes? Why do you want one and not the other?

587 Ans. I don't know what the difference is. I am satisfied with a vacuum distillation. That is all I claim.

Cross-int. 50. What is the product or products of vacuum distillation which are subjected to your process?

Ans. It is a heavy gelatinous oil, or amorphous paraffine so called.

Cross-int. 51. Who manufacture it?

Ans. Capitol Oil Company, E. F. Houghton, of Philadelphia; Merriam & Morgan, of Cleveland. They have licenses to manufacture.

Cross-int. 52. You mean that they manufacture the vacuum oil and also filter it under your patent?

Ans. I mean they filter vacuum oil.

Cross-int. 53. Who manufactures the vacuum oil which they filter?

Ans. I have known them to buy of the Rochester Company, and I think of H. W. C. Tweddle, of Pittsburg, or his agent.

Cross-int. 54. You spoke of parties who paid you a royalty of so much a gallon. Do you refer to the Capitol Company, Houghton, and Merriam & Thayer?

Ans. I do.

Cross-int. 55. Do the Rochester Company still carry on the business of vacuum distillation?

Ans. I can't say. They did the last time I had anything to do with them, in the fall of 1869.

Cross-int. 56. You were asked whether there was an objection found to the oils of Seccomb, Kehew & Thayer on account of their odor, and on account of the presence of crystallizable paraffine. Was the stuffing oil sold to you by those parties perfectly satisfactory, in every other respect, for currying leather?

Ans. It would have given very good satisfaction if those two objections could have been removed.

Cross-int. 57. What do you mean by crystallizable paraffine in distinction from paraffine not crystallizable?

Ans. I mean that one crystallizes and the other don't—the paraffine.

Cross-int. 58. I wish you would be a little more explicit, and state what you mean by its crystallizing, and state under what circumstances it crystallizes.

Ans. All I can say is, it crystallizes when it is cold.

588 Cross-int. 59. Then, when you say it contains crystallizable paraffine, do you mean anything more than that it contained paraffine which chilled at a certain temperature?

Ans. I only mean it crystallizes at a certain temperature.

Cross-int. 60. Was this true of the Rochester vacuum stuffing oil?

Ans. I never have seen any crystals in the Rochester stuffing oil.

Cross-int. 62. Did you ever see it exposed to the same temperature at which the crystals formed in the Seccomb, Kehew & Thayer stuffing oil?

Ans. I have seen it used for the same purposes of stuffing leather, but never have heard of or seen any crystals in it. I can't say as to whether the temperature was the same.

Cross-int. 63. When paraffine oil chills up, does it show paraffine crystals.

Ans. What they call vacuum distillation don't show any crystals that I have ever seen.

Cross-int. 64. If I understand you, the stuffing oil of fire distillation, when chilled, showed paraffine crystals, and the stuffing oil of vacuum distillation when chilled does not. Is that your meaning?

Ans. The A stuffing oil sold by the Lightfoot company at the time we purchased oil of Dr. Tweddle crystalized in cold weather. The vacuum stuffiing oil—I never have seen any crystals in it.

Cross-int. 65. Did the Seccomb, Kehew & Thayer stuffing oil crystallize in cold weather?

Ans. The Seccomb, Kehew & Thayer A stuffing oil did crystallize in 1868, in cold weather.

Cross-int. 66. Did they ever make any stuffing oil at any time that did not, as far as you know?

Ans. I never have seen any for the Lightfoot company. I don't know what they have done for other parties.

Cross-int. 67. Did you buy any stuffing oil from Dr. Tweddle that crystallized in cold weather?

Ans. Not that I know of.

Cross-int. 68. How did the objection to the Seccomb, Kehew & Thayer stuffing oil, by reason of the presence of crystallized paraffine, show itself on the currying of leather with it? What harm did it do?

589 Ans. It left white crystals on the leather.

Cross-int. 69. Did it discolor the leather? I do not now refer to the deposit of paraffine crystals.

Ans. No, sir.

Cross-int. 70. What was the gravity Beaumé of the stuffing oil which you had from the Rochester company?

Ans. The understanding was to run from thirty degrees to thirty-two degrees.

Cross-int. 71. What was the gravity of the stuffing oil you had from Dr. Tweddle?

Ans. I couldn't say, but I think it was a little lower than that of the Rochester oil. The doctor always claimed it was, and I think it was.

Cross-int. 72. Which had the lower gravity, the stuffing oils which the doctor sold you, or the railroad lubricating oil which you saw at his place?

Ans. I have no means of knowing; I couldn't test them. I couldn't say.

Cross-int. 73. Was the man you saw at Dr. Tweddle's works, who represented himself to be his foreman, a slender man without beard?

Ans. I couldn't give any description of the man.

Cross-int. 74. How long were you with him?

Ans. I should say I was there an hour or two at the works the first day.

Cross-int. 75. Was there crystallizable paraffine in the finishing oils (AX and AAX) which Seccomb, Kehew & Thayer sold your company?

Ans. The AX and AAX would crystallize at a low temperature—when it was very cold?

Cross-int. 76. Was that one of your objections to them in use?

Ans. It was.

Cross-int. 77. Did you tell Dr. Tweddle so?

Ans. I can't say whether I did or did not.

Cross-int. 78. Do you remember whether you told him about the odor as being an objection to them in use?

Ans. In our general conversation I have no doubt all those points were touched.

Cross-int. 79. Do you distinctly remember that you spoke to
590 him either of the crystallized paraffine, or of the odor in the AX and AAX finishing oils of Seccomb, Kehew & Thayer, as objections to them in use?

Ans. The objections to the odor of the AX and AAX was talked over between us. The crystallization of the paraffine I can't say anything about. That is a slight objection in that oil.

Cross-int. 80. Why was it a slight objection?

Ans. It crystallized at a so much lower temperature.

Cross-int. 81. Than what?

Ans. Than the A stuffing oil.

Cross-int. 82. If I understand you, the stuffing oil that you bought of Dr. Tweddle was not the railroad lubricating oil, but a somewhat different product. Am I right?

Ans. I suppose it was somewhat different.

Cross-int. 83. Did you suppose so from your own observation afterwards, or from what he told you he was going to make?

Ans. The railroad oil wouldn't answer my purpose. I carried a sample of the Rochester vacuum oil to Dr. Tweddle. He said he could make a better article, he thought, for our purpose.

Cross-int. 84. Did you want a heavier oil than the railroad oil?

Ans. I paid no attention to the railroad oil. I ordered an oil like the vacuum oil, from Rochester.

Cross-int. 85. How long were you with Dr. Tweddle when you first saw him?

Ans. I should say an hour or two; I couldn't state exactly.

Cross-int. 86. Any third person present?

Ans. The workmen round the place were there.

Cross-int. 87. I speak of persons who were present at your conversation with the doctor, hearing, or in a position to hear, what took place.

Ans. I don't know who was in a position to hear. My conversation was entirely with the doctor. I recollect of no other party talking that day.

Cross-int. 88. Was not the Rochester vacuum oil on sale in Pittsburg in August, 1868?

Ans. I don't remember whether it was or was not.

Cross-int. 89. You say that you sent a barrel of Seccomb, Kehew
591 & Thayer's finishing oil, AAX, to Dr. Tweddle by his request. Was that request by letter?

Ans. I ordered a barrel sent of our AAX by Messrs. Seccomb, Kehew & Thayer to Dr. Tweddle, at his request. I think his request was in writing, but I can't say. Messrs. Seccomb, Kehew & Thayer told me they had sent it.

Cross-int. 90. Do you remember how long that was after you returned from your interview with Dr. Tweddle?

Ans. I do not. I should judge it was some time in October.

Adjourned.

MARCH 5, 1872.

Cross-int. 91. You spoke yesterday of an interview with Dr. Tweddle which lasted an hour or two. I understand that this was at the Eclipse Works, Sharpsburg Bridge. Is that so?

Ans. My first interview was at the Eclipse Works, Sharpsburg Bridge.

Cross-int. 92. What interview did you have with him afterwards, and how long afterwards, and when?

Ans. He called at the hotel (the Union Depot Hotel) the afternoon of my leaving. I think it was the next day.

Cross-int. 93. Then, as I understand it, you first went to the Eclipse Works and saw the foreman. The next day you went there again and had an interview of an hour or two with Dr. Tweddle, and the next day, in the afternoon, you had an interview with him at the Union Depot Hotel. Is that correct?

Ans. I think it is.

Cross-int. 94. How long did the interview at the hotel last?

Ans. I should judge he was there an hour; possibly more.

Cross-int. 95. Was any third person present?

Ans. There was.

Cross-int. 96. Who?

Ans. My wife.

Cross-int. 97. When did you next see Dr. Tweddle after this interview at the hotel?

Ans. In Boston; I think in October following. I couldn't say as to the exact date.

592 Cross-int. 98. Did you ever see him before the interview at the Eclipse Works?

Ans. I have no recollections of ever meeting him before.

Cross-int. 99. Was your wife with you when you went out to the Eclipse Works the first day?

Ans. I am quite sure she was.

Cross-int. 100. How long should you say you were at the doctor's place the first day?

Ans. I should judge I stopped there an hour or two.

Cross-int. 101. Where was Mrs. Toppan while the foreman was showing you through the works?

Ans. She went partially through the works with us. I can't say but she went all round where he showed us.

Cross-int. 102. Whom did you first see when you arrived at the doctor's place that day?

Ans. I think it was some carpenters in the office they were fitting up. The foreman might have been in the room with them.

Cross-int. 103. Did you see there a clerk or book-keeper, a small-sized, elderly man?

Ans. I don't remember of seeing any such man.

Cross-int. 104. Was this room you are speaking of the doctor's counting-room?

Ans. A sort of an office, at the corner of a street.

Cross-int. 105. Was it his counting-room, or was it apparently used for other purposes, or by other people? Give us what information you can about it.

Ans. I judge it was the office to the works. I don't know whether you would call it a counting-room or not; it had samples in it. There was very little in it when I was there. It was under repairs, or they were just a building it; I don't remember which.

Cross-int. 106. I wish you would describe all that you remember to have seen, when you were shown through the works by the foreman, the first day when you were there.

Ans. As I went into the door, entered the works, the first thing I saw that he showed me was what he called two vacuum stills, with a passage-way between them; joining one of them was a large reservoir for oil, a tank. He carried me into the barrel-house, or repair-house,
593 whatever you call it. He showed me next the barrelled oils on hand. That is all that I had occasion to see.

Cross-int. 107. Did you see any more of the works the next day, when you were taken through them by Dr. Tweddle?

Ans. I have no recollection of seeing anything different?

Cross-int. 108. At what time of day were you at the Eclipse Works the second time?

Ans. In the latter part of the forenoon, if I remember right.

Cross-int. 109. When you got there did you not find that the doctor had gone into town?

Ans. I have no recollection of anything of that kind.

Cross-int. 110. Did you find the doctor there, or did you have to wait for him?

Ans. I think they sent to his house. He had my samples up there that I had left for him.

Cross-int. 111. What I ask is, did you find the doctor at the Eclipse Works when you arrived there on the forenoon of the second day, or did you have to wait for him to arrive?

Ans. I might have had to wait a short time, but I can't tell. I don't remember how that was.

Cross-int. 112. Do you not remember that when you went there on the second day you were told that the doctor had gone on to the city of Pittsburg, and that you might find him there, at the office of S. M. Kier, near the Union Depot Hotel?

Ans. No, sir.

Cross-int. 113. You are positive that you received no such message?

Ans. I have no recollection of receiving any such message.

Cross-int. 114. Did you call at Mr. Kier's office while you were in Pittsburg, at that visit?

Ans. I think I did.

Cross-int. 115. On what business?

Ans. To inquire about the responsibility, as much as anything, understanding he had some interest some way, I know not how.

Cross-int. 116. Of whom did you make your inquiries on that subject at that place?

Ans. I think I saw Mr. Kier.

594 Cross-int. 117. Did you tell him who you were, and why you asked about the doctor's responsibility?

Ans. Probably I did. That was my business.

Cross-int. 118. You think you told him that you wanted to make arrangments to obtain oils from the doctor for the Lightfoot company?

Ans. I have no doubt I told him that. I can't tell what my conversation with him was exactly. I simply inquired about the chances of getting oil.

Cross-int. 119. Why did you go to Mr. Kier to make those inquiries? Who sent you there?

Ans. I think Dr. Tweddle told me of it.

Cross-int. 120. Was this visit to Mr. Kier's place on the second or on the third day of your visit to Pittsburg?

Ans. I can't tell you which.

Cross-int. 121. Was it one or the other of those days?

Ans. I have no doubt it was one or the other of them.

Cross-int. 122. You say that when you went round the works in company with the foreman, at your first visit to the Eclipse Works, you saw what he called two vacuum stills with a passage-way between them, and joining one of them a large tank or reservoir for oil. How wide was the passage-way?

Ans. Wide enough to walk between them comfortably. I couldn't say whether it was three feet or six feet wide, or two.

Cross-int. 123. Were these vacuum stills in a house?

Ans. I think there was a roof over them.

Cross-int. 124. Were they upright or horizontal?

Ans. I don't understand the question. The stills, or the roof, or what?

Cross-int. 125. The stills.

Ans. I am not conversant enough with stills to understand what you mean by upright or horizontal.

Cross int. 126. Did you go through the passage-way between the two stills?

Ans. I did.

Cross-int. 127. Where to?

Ans. To the barrel-house, or repair-shop.

595 Cross-int. 128. In going through the passage-way to the repair house or barrel-house, did you pass through any door or gate?

Ans. I don't remember anything about it. It might have been and it might not; I can't say.

Cross-int. 129. What did you see in the barrel-house or repair-house?

Ans. Empty barrels.

Cross-int. 130. Can you give us some idea of the size and character of this building which you speak of as the repair-house or barrel-house?

Ans. It was a rough building. I couldn't give the dimensions. I paid no attention to it.

Cross-int. 131. Can't you give us any idea whatever of the size of it?

Ans. It would be all guess-work.

Cross-int. 132. In answer to the question "What did you see in the barrel-house or repair-house?" you answered, "Empty barrels." Did you see anything else in it?

Ans. I might have seen coopers' tools and a variety of things; but I remember only what I was looking for, the packages.

Cross-int. 133. You call an empty barrel a package?

Ans. I do.

Cross-int. 134. You say that joining one of the vacuum stills was a

large reservoir or tank for oil. What do you mean by joining—connected with it, or near to it; and if the latter, how near to it?

Ans. I mean near to it. I couldn't give you the number of feet.

Cross-int. 135. I don't want the exact number. I only want to see how near you can remember.

Ans. The tank I have reference to backed up on the street, as I remember it. The distance between the still and the end of the tank was but a short distance. I couldn't tell you within ten feet how near it was.

Cross-int. 136. Was it as much as twenty feet?

Ans. I have answered it just as near as I know how. I couldn't say whether it was three or twenty; the tank I looked into in passing along.

Cross-int. 137. Passing along to what?

Ans. To the barrel-shop.

596 Cross-int. 138. Did you order the stuffing oil before you left Pittsburg, on the occasion of the visit you have been speaking of, or did you wait for the doctor to send you a sample of what he could make?

Ans. He was to make us some samples.

Cross-int. 139. I am speaking of the stuffing oil. Did he make and send you a sample of the stuffing oil?

Ans. I believe he did.

Cross-int. 140. Did he send you such samples more than once before you gave him your orders?

Ans. The stuffing oil—I don't remember how that was.

Cross-int. 141. In answer to the 51st direct interrogatory you say that there was a verbal understanding that the doctor was to procure from Seccomb, Kehew & Thayer the AX and AXX finishing oils which he offered to curriers for use in their business; with whom was the verbal understanding had?

Ans. Some of the directors, or Mr. Lightfoot; I don't know who.

Cross-int. 142. Not with yourself, then?

Ans. No.

Cross-int. 143. When you were at the Eclipse Works the first day, and saw the foreman, did you give your name or state that you came from the Lightfoot Company?

Ans. I can't say positively that I did, but I have no doubt I gave my name and stated whom I represented.

Cross-int. 144. Did you carry any letters from anybody?

Ans. No, sir.

CHARLES TOPPAN.

597 *Complainant's Exhibit No.* 115, *taken before H. Farnam Smith, special examiner.*

[Office of J. R. Bartlett, commission-merchant in oils, mill and railroad supplies, No. 127 State street.]

BOSTON, *Sept. 27th*, 1869.

Price of Eclipse oils this day:

Neutral oil, No. 1 quality, @ 60c.
" " " 2 " @ 57½c.
Amber machinery, No. 1 quality, @ 55c.
" " " 2 " @ 50c.

Above prices subject to the market.

Truly, yours,

J. R. BARTLETT.

Deposition of Benjamin H. Lightfoot, taken before H. Farnam Smith, special examiner, Saturday, March 2, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainants:

Int. 1. What is your name, age, residence, and occupation?

Ans. Benjamin H. Lightfoot; 44 years of age; reside in Philadelphia. I am clerk and treasurer of the Lightfoot Currying Oil Company, and export oil to Europe.

Int. 2. What was your connection with the Lightfoot Currying Oil Company in 1868?

Ans. I was clerk and treasurer.

Int. 3. Do you know Dr. Tweddle, of Pittsburg; if so, will you state when you first became acquainted with him?

Ans. I know him; I met with him first in Philadelphia, in September or October of 1868.

598 Int. 4. State what the occasion was when you first met him.

Ans. He came to Philadelphia to meet with the directors of the Lightfoot Currying Oil Company.

Int. 5. What was the object of his meeting them?

Ans. To see if he could make an arrangement with the company to supply them with stuffing oil, and to sell their oils in the West.

Int. 6. State whether or not the company held patents for the use of paraffine oils or petroleum oils for curriers' purposes; and, if so, whether by the sale of the company's oils in the West, you mean the right to sell such oils under the company's patents.

Ans. The company did hold such patents, and it was the right to sell such oil under the company's patents which he wished to negotiate for.

Int. 7. State whether the negotiations with Dr. Tweddle were conducted on the part of yourself, or by the other officers of the company.

Ans. By the other officers of the company.

Int. 8. State whether or not, to your knowledge, those negotiations progressed so far that drafts of the contracts were prepared by your company or its solicitor.

Ans. It did; and there were drafts or agreements drawn.

Int. 9. When did you next see Dr. Tweddle, where, and on what occasion?

Ans. I saw him on the 27th or 28th of November, 1868, in Pittsburg, at his office, for the purpose of having those agreements executed.

Int. 10. State whether or not you went to Pittsburg expressly for that purpose, and whether you carried the drafts or agreements with you.

Ans. I did, and carried them with me.

Int. 11. When you showed the drafts to the doctor, what did he say?

Ans. I think he read them, and then said he wished his attorney to see them.

Int. 12. State whether or not you went with him to his attorney; if so, who the attorney was, and what took place on that visit.

Ans. I went with him to Bakewell's office, and saw Bakewell or his partner; do not positively remember which. The attorney read over the agreements, and objected to them as they were written, and

599 made some interlining with lead pencil, but afterward proposed to draw a new draft, which he did in lead pencil.

Int. 13. State whether or not you took the attorney's draft back with you to Philadelphia, and whether his emendations were accepted by your company, and whether any agreement was finally concluded between you.

Ans. I took the attorney's agreement back with me to Philadelphia, and submitted it to the company's attorney. The company declined accepting the agreement, but I think the company's attorney drew a second agreement, somewhat modified, but this agreement never was executed or presented to Dr. Tweddle.

Int. 14. Had your company, before you made that visit, purchased any oil of the doctor? If so, will you state what kind of oil it was, and its price, and what the quantity of oil was, as nearly as you can?

Ans. The company did purchase oil of Dr. Tweddle before that visit. It was a very dark, heavy oil, used for stuffing. The price, I think, ranged from twenty-five to thirty cents per gallon. I can't state positively as to price. I think there was an order given him for *a* about a thousand barrels, but whether it was all before my visit there I can't say. I think it was.

Int. 15. While you were at Pittsburg did you have any conversation with the doctor about the character of his stuffing oil, and about procuring from him any finishing oils? If so, will you state when and where such conversations took place, and what the conversation was?

Ans. The only conversation that I remember between Dr. Tweddle and myself in reference to the oils was in passing from his office to the office of his attorney. I said that if we could get an oil as sweet as the stuffing oil, which would be suitable for oiling off, it would be very desirable. He said that he did not know as we could do any better for the present than use the AAX manufactured by Seccomb, Kehew & Thayer, but he thought he would soon be able to make an oil of as *a* light color as the AAX, and as sweet as the stuffing oil.

Int. 16. Will you state whether or not the odor which existed in the finishing oils you were then using was objectionable, and in what way?

Ans. The odor in the AAX or finishing oil was objectionable, on account of the smell left upon the leather. Many of the curriers will not use it, up to this time, on account of the odor from the oil.

600 Int. 17. State how you should have regarded oils for your use like the samples marked "Exhibits Nos. 111 and 112," if they had been shown you in 1868.

Ans. We should have considered it a very great advantage to our business if we could have got such oils at a reasonable price.

Int. 18. Were you the patentee of the patents held by the Lightfoot Company?

Ans. I was.

Cross-examination by Causten Browne, esq., in behalf of the respondents:

Cross-int. 1. Did your company buy those stuffing, finishing, and oiling-off oils exclusively from Seccomb, Kehew & Thayer, excepting what you got from the Rochester Company and from Dr. Tweddle?

Ans. We did not.

Cross-int. 2. Seccomb, Kehew & Thayer, then, had no agreement with your company by which, at any time, you were to get the oils from them exclusively?

Ans. There was an agreement part of the time, of which I do not remember the exact wording. It was in writing. During that time the company got most, if not all, of their finishing oils from Seccomb, Kehew & Thayer.

Cross-int. 3. From what other manufacturers did you ever get finishing oils besides Seccomb, Kehew & Thayer? I mean by finishing, both finishing and oiling-off oils.

Ans. I do not remember all of them. There was Moorhouse, Merriam & Co., of Cleveland, Libby & Clark, of New York, and one or two other firms of New York which are now out of existence—I don't remember their name; Stephenson & Co., of Philadelphia. I don't remember the names of any others. There were quite a number. I do not now remember of any others in Boston.

Cross-int. 4. Was the finishing oil which you bought from these various parties the paraffine lubricating oil which they were offering in the market at that time, or was it a special product prepared with reference to its use in currying?

Ans. The oils that were in the market were used more or less. What the company wanted was the sweetest paraffine oil, free from any crystallized paraffine in it, and as heavy in gravity as they could get.

601 Cross-int. 5. Will you explain what you mean by crystallized paraffine in the oils in question? How did it show itself in your use of the finishing oils in which it existed?

Ans. The paraffine, in a crystallized state, would not penetrate the leather, but remain on the outside, like the scales of a fish.

Cross-int. 6. Was the presence of crystallized paraffine objectionable as a stuffing oil?

Ans. It was. It would act in very much the same manner. I think that rather more of the paraffine would penetrate the leather, owing to the tallow and oil being heated together and combined.

Cross-int. 7. Was there crystallized paraffine in the stuffing oil which Dr. Tweddle furnished and sold to your company?

Ans. No, not to my knowledge.

Cross-int. 8. Where are the drafts of the agreement referred to by you, as having been prepared and discussed at Pittsburg?

Ans. I think they are here in this office.

Cross-int. 9. Who was the company's attorney in these negotiations in Pittsburg?

Ans. Daniel A. Gleason.

Cross-int. 10. Who were actively concerned in these negotiations between Dr. Tweddle and the company besides those persons you have mentioned?

Ans. Moses F. Winn and Edward W. Cobb, were the principal ones; they are both of Boston; but I think that George G. Lewis and Thomas Sparks, of Philadelphia, had something to do with it.

Cross-int. 11. When did you first see the samples marked "Exhibits Nos. 111 and 112?"

Ans. The first of this week, on my arrival here from Philadelphia.

Cross-int. 12. You say you told Dr. Tweddle that if you could get an oil as sweet as the stuffing oil, which would be suitable for oiling off, it would be very desirable. By sweet, you mean free from odor, I suppose?

Ans. Yes.

Cross-int. 13. Why would not Dr. Tweddle's stuffing oil answer for lubricating?

Ans. The curriers preferred light-colored oils. Besides, it would stain the leather.

602 Cross-int. 14. What makes you think it would stain the leather? Why should it do so? I am speaking, as I suppose you are, of Dr. Tweddle's stuffing oil.

Ans. Because it was so dark in color.

BENJAMIN H. LIGHTFOOT.

Deposition of Edward W. Cobb, taken before H. Farnam Smith, special examiner, Tuesday, March 5, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Edward W. Cobb; fifty-seven years of age. I reside in Boston, Mass. I am a dealer in seeds and horticultural matters.

Int. 2. If you were any way connected with the Lightfoot Currying Oil Company in 1868, state what that connection was.

Ans. I was a director in the company at that time.

Int. 3. If you were present in the fall of that year at an interview in Philadelphia, between some of the officers of that company and Dr. Tweddle, of Pittsburg, will you state as nearly as you can, when the meeting was, who was present, and what was the object of the interview with him at that time?

Ans. I was present at an interview with Dr. Tweddle in September, 1868, with some of the directors of the Lightfoot company. Mr. Winn was there, I remember, and some of the directors from Philadelphia, and the treasurer was present. The object of the interview was to see if we could make an arrangement with him to furnish the company with stuffing oil, and also to license him to sell the oil for currying purposes.

Int. 4. State whether or not, at that interview, there was a verbal arrangement made for granting Dr. Tweddle a license, which it was understood was to be subsequently reduced to writing and was to be executed by the parties.

603 Ans. There was such a verbal arrangement made.

Int. 5. State, as nearly as you can, what the arrangement was.

Ans. The arrangement was that he should sell oil for currying purposes, and that he should pay the Lightfoot company a royalty of three cents a gallon on all the oil he sold.

Int. 6. Will you state whether or not anything was said at that time about his purchasing oils of Seccomb, Kehew & Thayer for finishing purposes? If so, state what it was.

Ans. He was desirous of selling the finishing oil made by Seccomb, Kehew & Thayer, and we were also anxious that he should sell it, and he agreed, or was to agree, if the agreement had been consummated, that he would purchase the finishing oils of Seccomb, Kehew & Thayer, and would pay us a royalty of three cents a gallon on all the oil so purchased of them.

Int. 7. At what price was he to purchase the oils as compared with the price which the Lightfoot company itself paid?

Ans. He was to pay the same price which the Lightfoot company paid for it.

Int. 8. If you have in your possession any paper written by you after that interview, and while its particulars were fresh in your mind and from which you have refreshed your recollection, will you state what the paper is, and produce it as an exhibit?

(Objected to.)

Ans. I have a letter which I wrote to Mr. Lightfoot, the treasurer of the Lightfoot Oil Company, written in December, 1868, which I produce to be marked "Exhibit No. 116."

Int. 9. In this letter I find a reference to a memorandum made and

voted to be accepted at the last directors' meeting, and which Dr. Tweddle took a copy of at the time. Have you that memorandum, or do you know where it is?

Ans. I haven't that memorandum. I think I was the bearer of that memorandum from Philadelphia to Boston. I think I gave it to Mr. Gleason, the attorney for the Lightfoot Company, to draw an agreement from. I haven't that memorandum myself, and don't know what has become of it. I presume it was either left with Gleason, or returned to Philadelphia to the treasurer.

604 Int. 10. I find also in this letter a reference to Seccomb & Co. Does that mean Seccomb, Kehew & Thayer?

Ans. It does.

Cross-examination by Causten Browne, esq., in behalf of the respondents.

Cross-int. 1. When was the interview in Philadelphia between the directors of the company and Dr. Tweddle, which you refer to in your direct examination?

Ans. It was during the month of September, 1868.

EDWARD W. COBB.

Complainant's Exhibit No. 116.—*H. Farnham Smith, special examiner.*

BOSTON, *December* 16, 1868.

B. H. LIGHTFOOT, Esq.,
Philadelphia:

DEAR SIR: I am at length enabled to reply in reference to the Dr. Tweddle license matter about which there appears to be so much trouble to get into the right shape. Messrs. Sparks and Lewis will see that we here (some of us,) have changed front in some particulars since I sent you the draft of a license which Dr. Tweddle, or his attorney, refused to execute. With how much wisdom this change has taken place, time only must determine. I will say here, however, that we intended, as I understood it, to license Tweddle only, and not his assigns or executors, or anybody but H. W. C. Tweddle. The first agreement was drawn, in almost every particular, to correspond with the memorandum we made and voted to accept at our last directors' meeting, and which Dr. Tweddle took a copy of at the time. He having refused to sign that, Mr. Gleason thinks we are justified now in asking of Tweddle something more than we then anticipated was necessary to ask, that is, an agreement from him to furnish us the stuffing oil, (as per article fifth, not yet incorporated in the new draft.)

☞ The understanding with Mr. Winn and myself was, in accord-
605 ance with our conversation with Tweddle in Philadelphia, in September, that he should procure the finishing oil of Seccomb & Co., at the same price that the company pay them for it, we to have three cents royalty from Tweddle in it; and therefore we do not wish in the license, to say anything about the finishing oil, nor is it necessary, as the oil obtained of them will be already branded by the Seccomb Co. You will be able, however, after reading Gleason's letter to me, which I enclose herewith, to judge what he advises on all these points. It will be seen, also, that he advises, in the closing paragraph, an examination, by an expert, of Tweddle's patents before executing any agreement whatever with him, which will involve an expense to the company, as near as I can learn, of two to three hundred dollars. And then, Mr. Winn suggests, it will be seen, and for what

reason, I am certainly not aware, that we ascertain Tweddle's relations to the Rochester Company, before executing a license to him. So you see the matter is becoming complicated, and perhaps unnecessarily so.

In this state of the case, as we are not a majority of the directors here, and therefore cannot decide these questions, you had better immediately call the Philad. directors together, and, after reading and digesting these letters carefully, submit all these points to be decided by them by vote. Will you not do this at once?

The fifth article to the agreement or license, which Gleason did not incorporate in the paper, but which is left for the consideration of the directors, is quite important to the company, and certainly worth considering before the license is executed by us. When, however, the substance of this article is inserted in the agreement which we have here assented to, and when it is agreed to by Dr. Tweddle, I for one, should be ready to execute the license, with or without the examination of an expert. I consider this (the fifth article,) by far the most important of all Gleason's suggestions, as contained in the letter to me. If Tweddle does not consent to it in this shape, let the agreement run for one, two or three years instead of five. That would be better for the company, and perhaps he would sign such an agreement for the shorter, when he would not for the longer term. I think the directors will see pretty plainly my position in this matter. If they do not, I will state plainly that I should wish to execute the license at once if Tweddle will agree to furnish the company the oil, as stipulated in this
606 fifth article. It will not be necessary for Mr. Winn and myself to be present in order to settle these matters. I think & I hope the other directors will take the responsibility, after being in possession of all the facts known to us.

Please let me hear from you as soon as any action is taken.

Yours, etc.,

E. W. COBB.

(Endorsement:) E. W. Cobb. 12, 16, '68. About D. Tinsdale. Agreement and furnishing him with finishing oil.)

Deposition of Moses F. Winn, taken before H. Farnham Smith, special examiner, Tuesday, March 5, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Moses F. Winn; age, 66 years; residence, Woburn, Mass.; I am a leather manufacturer.

Int. 2. Have you had any connection with the Lightfoot Currying Oil Company? If so, what has it been?

Ans. I have been a director in the company since its formation, and president for the last several years; since 1867, I think.

Int. 3. Were you, in the fall of 1868, present at a meeting of the directors of the company, in Philadelphia, at which Dr. Tweddle, of Pittsburg, was present?

Ans. I was; I don't know that Dr. Tweddle was in the meeting of directors; I don't recollect that he was, but a portion of the directors met him at the Continental, and made arrangements with him in the interest of the company.

Int. 4. What arrangements were they, that you speak of?

607 Ans. To sell curriers' oil, or oils for curriers' purposes, under a license from the company, at a fixed royalty.

Int. 5. Will you state what that royalty was?

Ans. I do not remember what it was.

Int. 6. Will you state whether or not the company, at or about that time, purchased any oils of Dr. Tweddle? If so, what kinds?

Ans. I think they had a quantity of oil which they had tried, and were satisfied with a dark green, heavy stuffing oil, or vacuum oil; I don't know which term we gave it at that time. Those are two phrases that are given to it.

Int. 7. If you had any conversation with the doctor at that time about the manner of using these oils, or about the qualities which it was desirable they should possess, will you state what the conversation was?

Ans. I stated distinctly at that time the importance of all the oils that were used in currying leather to be as free from odor as possible, making a statement of the trouble of having common oils that were full of odor, in giving curried leather a bad smell, as we have to use those oils in connection with fish oils. I also explained to him the manner in which those oils could be successfully used, and also agreed to send him a printed statement of the manner of mixing, and I did so, or caused it to be done.

Int. 8. If you said anything to him about the parties of whom you procured your AX and AAX oils for finishing, and about the qualities of the oils you procured of them, state what you said to him and what the doctor said in reply, if anything.

Ans. In the statement made upon the mode of using the oils, we termed stuffing oils, AX and AAX oil, meaning three grades of oil that we recommended the use of, those oils from Seccomb, Kehew & Thayer, because they were the most free from odor. I had before explained to him the great importance of having it so. I think the doctor says you won't be able to get any better oil than you get from them, in that particular.

Int. 9. State whether or not the doctor said anything to you about supplying you with finishing oils AX and AAX, as well as with the heavy dark green stuffing oil.

Ans. I think he did not.

608 Int. 10. Did you afterwards see the doctor here in Boston, or know of his making a visit here?

Ans. I do not recollect of seeing the doctor here, and I think I recollect being told he was here, by some one. I have no recollection of meeting him here.

Int. 11. Do you remember about what quantity of stuffing oil your company purchased of Dr. Tweddle?

Ans. I do not recollect, as I had no account of it except at the agent's books. I saw a sample of it at the agent's office, and so far as I could judge, it was satisfactory. I think I tested the first sample that came at my own factory out at Woburn. I didn't devote a great deal of time to those matters and cannot answer fully.

Cross-examination by Causten Browne, esq., in behalf of the respondent.

Cross-int. 1. Has the Lightfoot Company done any business since the autumn of 1868?

Ans. It has been pursuing the same business as before.

Cross-int. 2. Will you state exactly what the business done by that company has embraced?

Ans. The patent claims the use of the oil on leather; to get at it in short. We have given all leather manufacturers the application of the oil by purchase from our agent. That is as short as I can get at it.

Cross-int. 3. Do you mean that the business of your company consisted in granting licenses under your patents?

Ans. I do, both verbal and written.

Cross-int. 4. Were you present at the meeting at the Continental, mentioned in your answer to the third direct interrogatory?

Ans. I was, at the interview I state, there with Dr. Tweddle.

Cross-int. 5. I refer to the time when, as you say, arrangements were made with him to sell oils under a license from your company, at a fixed royalty. Were you present when that was done?

Ans. I was.

Cross-int. 6. Do you not remember about what the royalty was?

Ans. I shouldn't want to fix upon that, for it isn't in my mind to designate just the sum. It was talked of much higher than finally fixed upon. It was wrote up and agreed upon afterwards. I don't recollect about it; I shouldn't want to say.

609 Cross-int. 7. Which of Seccomb, Kehew & Thayer's oils were most objectionable for currying purposes, the stuffing oils, or the finishing oils?

Ans. All the stuffing oil we ever used from him was termed A oil. That we left off when we got the Rochester oil, and also the thick oil from Dr. Tweddle. We liked the last-named oils the best.

Cross-int. 8. I understand that before you bought any stuffing oil from the Rochester Company you bought stuffing oil known as A oil, and finishing oils known as AX and AAX oils from Seccomb, Kehew & Thayer, of their manufacture. Did you find each of these three oils of their manufacture objectionable on account of the odor? I do not now speak of any other objection.

Ans. We found them so then, and do now, but they are the best we can get.

Cross-int. 9. You do not use their stuffing oil now, do you?

Ans. No; we do not.

Cross-int. 10. Now you say that you found the A, the AX, and the AAX Seccomb Kehew & Thayer oils all objectionable on account of odor. Was either one of them more objectionable than the others in that respect? If so, which one?

Ans. I don't know as there was any difference, in the uses that we put them to, as to being objectionable in that respect. They are all objectionable in that respect, to a certain degree. They are not so pure as we wish them. The prices that we purchase them at compels us to purchase them, rather than oils that are less odorous.

Cross-int. 11. I don't quite understand what you mean when you speak of your purchasing them, because I understood you to say that your company's business consisted only in granting licenses under your patent. Will you please explain fully what you mean by your company's purchasing the oil; and explain your way of doing business, in which these purchases came in?

Ans. My first answer is, that I didn't answer any question that was put to me, intending me to be understood that the company did nothing only license. They do more. Our agents sells oils to the parties who are authorized to use it, at a price above the purchase-price of course, such prices to be fixed by the directors of said company.

610 Cross-int. 12. Are your licenses restricted in working under your patents to the use of oils so sold to them by the company's agent?

Ans. If they want to buy oil where they please, then they take a license and pay us a royalty. Otherwise, they buy their oil of our agent, and no further license is required.

Cross-int. 13. Who is your selling agent?

Ans. Seccomb, Kehew & Thayer. Either directly or through travelling agents.

Cross-int. 14. Have they had that agency ever since your company began operating?

Ans. No; they have not.

Cross-int. 15. Who else has had it, and when?

Ans. The company, under its first organization, made the treasurer its agent, with assistant travelling agents. They also kept oil in their store to supply the trade under their patents. We have had no other agent.

Cross-int. 16. What price have you paid Seccomb, Kehew & Thayer for their AX and AAX oils, respectively?

Ans. We have varied in price as the crude oil varied at the wells, from thirty-four to forty-two cents as near as I recollect. The range of prices for each of the three kinds of oil has varied from two to three cents a gallon.

Cross-int. 17. Now please state the average price of the A oil, the average price for the AX oil, and the average price for the AAX oil, each by itself, which your company has paid Seccomb, Kehew & Thayer.

Ans. I couldn't do that without going to their books. I haven't paid attention enough to it to carry that in my mind, by any means.

Cross-int. 18. Did you find any objection for currying purposes to the Seccomb, Kehew & Thayer stuffing oil except the odor; if so, will you state fully?

Ans. We find that there is not body enough to the A oil for making stuffing successfully. The thick vacuum oil does better. In order to make stuffing, we want an oil with as much consistency as we can have to unite with tallow, making a body sufficient to adhere to a side of leather hung perpendicularly in a warm room. Also entire
611 freedom from odor. There were some other little objections we had to the Seccomb, Kehew & Thayer stuffing oil, which I don't recollect.

Cross-int. 19. Did Seccomb, Kehew & Thayer ever try to furnish you with a heavier or a thicker stuffing oil, to meet that particular objection of want of body?

Ans. Not since we have had the vacuum oil, to my knowledge.

Cross-int. 20. Did they before you got the vacuum oil?

Ans. I don't recollect that they did.

Cross-int. 21. Did they never furnish you samples of what they could do in the way of a heavier stuffing oil?

Ans. Not unless it might be a small sample, in bottles, or something like that.

Cross-int. 22. Did they ever find you with small samples of such stuffing oil in bottles or cans, or anything else, no matter what?

Ans. Nothing more, as I recollect, than bottles shown at the office.

Cross-int. 23. Were such sample bottles furnished by them more than once?

Ans. I don't recollect particularly about that. They frequently showed sample bottles when I went into the office.

Cross-int. 24. I suppose you stated to them that the stuffing oil wasn't

heavy enough, and asked them if they could not make it heavier, did you not?

Ans. Perhaps I might. We were feeling our way along to the use of those oils, and suggesting frequently to oil manufacturers what we needed as a substitute for fish and neat's-foot oils.

Cross-int. 25. Don't you remember whether or not you made any efforts to get a heavier stuffing oil for Seccomb, Kehew & Thayer, or anybody else in this neighborhood, before getting the Rochester oil?

Ans. Nothing that I recollect, except as stated in the previous answer.

Cross-int. 26. From whom do you get your stuffing oil now?

Ans. We use the Capitol Oil Company's oil.

Cross-int. 27. That is vacuum oil, I believe?

Ans. Yes, a filtered vacuum oil.

Cross-int. 28. Will you give the names of any person you know of connected with that company?

Ans. James Toppan, Granville Parks, myself.

612 Cross-int. 29. Do you three gentlemen compose the company?

Ans. Some other parties have a small interest.

Cross-int. 30. Where does the company manufacture?

Ans. At Woburn, Mass.

Cross-int. 31. Where does Mr. Granville Parks live?

Ans. At Woburn.

Cross-int. 32. Where does the company gets its vacuum oil from to filter?

Ans. From Rochester part of the time. Some of the time from Dr. Tweddle's agent—supposed to be Mr. Bartlett.

Cross-int. 33. It does not make any vacuum oil itself, does it?

Ans. No, sir; not as yet. It proposes to.

Cross-int. 34. Has it got a license from anybody for that purpose?

Ans. I don't understand the question.

Cross-int. 35. What do you not understand?

Ans. Having a license to manufacture Capitol oil.

Cross-int. 36. You say you propose to manufacture your own vacuum oil, to be filtered. Do you propose to manufacture it by anybody's patent?

Ans. No, sir.

Cross-int. 37. Does the Capitol Oil Company furnish stuffing oil to the Lightfoot Company, or its selling agent?

Ans. We have made no such arrangement as yet. The Capitol Oil Company manufactures lubricating oils principally.

Cross-int. 38. The 26th cross-interrogatory was, "From whom do you get your stuffing oil now?" and your answer was, "We use the Capitol Oil Company's Oil." Do you pay them for it? When I say you, I mean the Lightfoot Company.

Ans. We pay them nothing for it, of course, as yet.

Cross-int. 39. Why do you pay them nothing of course, as yet?

Ans. We (the Capitol Oil Company) manufacture the oil on our own premises. We have made no arrangement with them as yet, and we manufacture principally lubricating oils.

Cross-int. 40. Does the Lightfoot Company pay the Capitol Oil Company for the stuffing oil which it has from the Capitol Oil Company?

Ans. It does not have any.

613 Cross-int. 41. Where does the Lightfoot Company get its stuffing oil from, then?

Ans. It is not selling any that I know of.

Cross-int. 42. When did it cease selling stuffing oil?

Ans. I don't know when the last was sold. Have not looked in the agent's books.

Cross-int. 43. About when was it?

Ans. Couldn't say.

Cross-int. 44. Where did they get the last stuffing oil from that they did have?

Ans. As near as I recollect, from the Rochester Oil Company.

Cross-int. 45. Who is the agent whose book will show the last purchase or sale of stuffing oil by the Lightfoot Company?

Ans. Seccomb, Kehew & Thayer, unless there has been other arrangements recently, as near as I recollect.

Cross-int. 46. Do you mean, unless there has been arrangements with some other parties to be the company's agent?

Ans. Yes.

Cross int. 47. What officers or stockholders of the Capitol Oil Company, if any, are also officers or stockholders of the Lightfoot Company?

Ans. Myself; and I don't know whether any of the other parties own any of the Lightfoot stock or not; can't say.

Cross-int. 48. I understood you to say that the Seccomb, Kehew & Thayer AX and AAX oils were the best that you could get now without paying a higher price than you could pay to advantage. Is that so?

Ans. I don't recollect as I understood the question to mean now. I understood the question to mean when the Lightfoot Oil Company were making the arrangements.

Cross-int. 49. In the 8th cross-interrogatory, being asked whether you found each of the three Seccomb, Kehew & Thayer oils objectionable on account of the odor, you say, "We found them so then and do now, but they are the best we can get." Do you mean the best you can get without paying a higher price than you can pay to advantage?

Ans. That was the meaning. That was so at the time?

Cross-int. 50. What can you now get that is better without paying a higher price than you can pay to advantage?

614 Ans. There is constant improvement being made in oils for the better, and what there is in the market now I cannot tell that is better.

Cross-int. 51. In your answer to the 7th interrogatory, speaking of the oils used in currying leather, you say you have to use these oils in connection with fish oils. Please explain this.

Ans. I mean that the curriers mix paraffine oils with the fish oils for currying.

Direct examination resumed:

Int. 12. The prices which curriers can afford to pay for paraffine oils to be mixed with fish oils, are dependent, I suppose, upon the price of fish oils.

Ans. Largely dependent upon that. If fish oils are very high, much more paraffine oils are used. There needs to be a margin of about twenty-five cents to make it a strong object for curriers to use paraffine oils of low price.

Int. 13. What was the price of fish oils in 1868, and what is the price now?

Ans. In 1868, if I recollect right, they were from eighty-eight to ninety-six cents. Now they are from fifty-eight to sixty cents. By fish oils I mean cod-liver oil, known by the term in trade of Bank and Labrador oils.

MOSES F. WINN.

Deposition of Malcom C. Greene, taken before H. Farnham, Smith, special examiner, Wednesday, March 6, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Malcolm C. Green; 34 years of age; residence, Boston, Mass. I am a stockholder and salesman in the Downer Kerosene Oil Company.

Int. 2. State whether or not you were in the employment of the
615 Downer Kerosene Oil Company, in New York; and, if so, in what capacity and when?

Ans. I was; as agent, from May, 1863, to February, 1868.

Int. 3. Will you state whether or not, while you were there, Dr. Tweddle ever showed you samples of his neutral topaz oil?

Ans. He did not.

Int. 4. State whether or not he showed you samples of any of his oils?

Ans. I never saw any of his oils.

Int. 5. State whether or not, to your knowledge, the doctor ever exhibited in your office in New York, to any one, samples of his neutral topaz oil.

Ans. To the best of my knowledge and belief I have never seen the doctor in my office in New York.

Int. 6. When and where did you first see samples of Dr. Tweddle's neutral topaz oil?

Ans. In the summer of 1869.

Int. 7. Who showed them to you?

Ans. It was a sample of oil brought in by Mr. Yeomans, of the firm of Yeomans & Goss. Mr. Joshua Merrill showed the samples to me.

MALCOLM C. GREENE.

Deposition of Samuel Downer, taken before H. Farnam Smith, special examiner, Wednesday, March 6, 1872.

Direct examination by Chauncey Smith, esq., in behalf of the complainant:

Int 1. What is your name, age, residence, and occupation?

Ans. Samuel Downer; sixty-five years of age; reside in Boston; and am president of the Downer Kerosene Oil Company.

Int. 2. What connection have you had generally with the manufacture of petroleum oils.

Ans. In 1834, thirty-eight years ago, in company with my father and brother-in-law, under the firm of Downer, Austin & Co., I became
616 engaged in the manufacture of whale and sperm oil, and sperm candles, to which was afterward added the manufacture of lard-oil. After twelve or fourteen years, my father, from age, and my brother-in-law, from ill health, retired from business, and I remained alone, conducting the same business. Late in 1853 or early in 1854, I became acquainted with Dr. Philbrick, and with Luther and William Atwood, they then being engaged in the manufacture of hydrocarbons from the coal-tar of the gas-houses. In 1854 I undertook the selling of their coup oil, making the first sale in July, 1854. At that time Mr. Joshua Merrill was engaged as salesman to sell that oil. After the breaking up of that company, we erected works on a small scale, on the Boston wharf, and after some changes, Mr. Joshua Merrill was put in superintendent. From that time my interest in the manufacture of

whale and sperm oil decreased, and my interest with hydrocarbon oils increased. After Mr. Merrill's visit to Europe, we began to work the Albert coals. The business on hydrocarbons up to that time had been exceedingly disastrous. From that time it became profitable. I noticed in Mr. Merrill a great aptitude for mechanical and chemical improvements and inventions, and caused to be built for him a laboratory, where he had full liberty to make any experiments he pleased, without any particular regard to expense. This business continued until 1858 or 1859, when the discovery of petroleums on Oil Creek and in Virginia, at first partially, and eventually entirely, superseded the manufacture of oil from coal. In 1861 I went out to Oil Creek in company with Mr. W. H. L. Smith, and erected at Corry, Pennsylvania, petroleum works to endeavor to meet the great influx of oils from the wells. That business, without material change, we have pursued up to to-day.

Int. 3. Have you taken any considerable degree of interest in the manufacture of lubricating oils from petroleum, and endeavored to keep yourself acquainted with the improvements made in such oils, and the extent of their manufacture and use?

Ans. I have. When we were engaged in the manufacture of sperm oil, it was the universal belief, both in this country and England, that there was no known substitute for lubrication on fine bearings, like spindles. The article was growing less in production and the demand greater for use for that purpose of fine machinery, and very great efforts had been made to find a substitute in other oils or other prepara-
617 tions, and, as far as I know at the time, without any decided success. When Dr. Philbrick, in 1854, first showed me the hydrocarbon oils which he manufactured, and which were very thin, with very high boiling-point, and specific gravity heavier than water, he showed me that the mixture of those oils with whale, lard, castor, and other oils, stopped their absorbing oxygen from the air, and becoming thick and sticky. I viewed with him two rooms of a cotton and woolen factory run with a mixture of coup oil, and other inferior fatty oils, to the entire satisfaction of the superintendent of the room. That convinced me that a substitute for sperm oil had been found; and I went with all the ardor I was capable of into its introduction, improvement, and use, and have continued that interest ever since. I would like to observe, that I am no chemist and no mechanic, but I take a very great interest in developing those that are.

Int. 4. Have you been accustomed to keep a record of you whereabouts, so that you can tell whether at any particular time you visited any particular place?

Ans. After I built my factory, in 1861, in Pennsylvania, and from the rapid changes of location in the oil business and the buying and moving of oil having been appropriated to me as my part of the business, I had occasion to be absent from my home fully one-half of my time. I earlier kept a more imperfect record, but in 1864 I commenced merely jotting down each day where I was. That I have continued to the present time, as a matter of convenience.

Int. 5. Will you state what days you were at Pittsburg in the year 1867.

Ans. I find by looking at that memorandum, in 1867, April 24th, 25th, 26th, 27th, and 28th I was in Pittsburg.

Int. 6. Will you give all the days in which you were at Pittsburg in 1868?

Ans. In 1868, I find by my memorandum, I was in Pittsburg March

3d, 4th, 5th, 6th, 7th, 8th, 9th, and 11. In making up this book, if I am at two places in a day I put them both down.

Int. 7. State whether or not while you were at Pittsburg on those days you went to the office of Lockhart & Frew. If so, state whether or not you saw Dr. Tweddle at that time, and who else you saw.

618 Ans. My visit to Pittsburg at that time was to attend a convention of oil dealers in regard to the excise law. [I wrote a long letter to Mr. Wm. B. Merrill in regard to the convention and other oil business, and I find in the postscript of that letter an allusion to Dr. Tweddle in these words: "Dr. Tweddle showed me a list of fires in oil works since the commencement. The list is long and perfectly fearful. He does this because he considers his way takes away all risk. Tell Joshua one of his numerous patents is dropping oil on pipes heated by superheated steam and running through a vacuum whilst being dropped on. I have seen his oil. His products are, naphtha, twelve per cent., about; illuminating oil, sixty-three per cent., about; lubricating, about five per cent.; residuum, seventeen per cent.; waste, three per cent.; no alkali or acid." I left Pittsburg the next day. We broke down exactly opposite the old Lucesco Works. We were detained there many hours, and whilst there, on March 8th, I wrote a letter, from which I make the following extract: "Dr. Tweddle offered to carry me to see his process, but I had not time, and it was too unpleasant. This seventeen per cent. residuum is very sweet, but without any show of paraffine; was not liquid in the warm office, and is, the doctor says, very thick. If I understand him right, he drizzles oil in a vacuum or pipes heated by superheated steam, and this seventeen per cent. of residuum is running out the whole time at the bottom. The doctor talks large, but I fear he has already embarrassed himself. His white oil, without acid or alkali, does not stink, but it has not a marketable smell. That is a dodge nobody yet seems to have got hold of but us. He is spending money, and sanguine. If he succeeds there, an oil-factory is boilers for steam and a vacuum-pot. Lockhart thinks he will succeed."] I was at the office of Lockhart & Frew, as stated in that letter. I rely from memory chiefly from the letter, but not entirely. When in the office of Lockhart, Frew & Co. I saw, I think, Mr. Frew, and Mr. Gracie, and Dr. Tweddle. The samples were shown to me. My attention was principally directed to the illuminating oil, but I noticed both the lubricating and the residuum. I feel quite confident the lubricating was a lemon-yellow color, partially chilled, showing paraffine crystals, with the usual still smell, and somewhat thinner than the paraffine oils of commerce.

(Passage in brackets seasonably objected to.)

Int. 8. What oil was that which you referred to as white oil in your letter?

619 Ans. Illuminating oil.

Int. 9. Who gave you the percentages of the oil which you have given from your letter?

Ans. I think, sir, it was given me either by Mr. Gracie or Mr. Frew. We were all together talking, and Dr. Tweddle, I think, was called out on business.

Int. 10. When and where did you first see the neutral topaz oil manufactured, as you understood, by Dr. Tweddle?

(Objected to.)

Ans. I saw it in the summer or late in the spring of 1869; I am not sure. I think I saw the first sample in New York, and afterwards in Boston, at which time it was publicly offered for sale.

Int. 11. State what days in 1869 you were in Pittsburg.

Ans. In 1869 I was in Pittsburg on February 6th, 7th, 8th, and 9th; May 18th, and 19th; June 14th, and 15th; October 1st, 2d, and 3d.

Int. 12. If at either of these visits you had an interview with Dr. Tweddle, in which the manufacture of neutral topaz oil was the subject of conversation, will you state when and where that interview was, and what passed between you?

(Objected to.)

Ans. I found, by looking over the files of letters, that I wrote home to Joshua Merrill this reference to Dr. Tweddle, October 2, 1869. "And now I have something to tell you about Dr. Tweddle. I went into Lockhart & Frew's counting-office to see Mr. Lockhart, returned last week from a five months' tour to Europe. I found the office entirely vacant, except Dr. Tweddle, who has a desk there. He immediately commenced on lubricating oil. He says, 'Why have you put your price down in Boston to fifty-five cents? I sell a great deal there, and we may keep it up just as well as not. I have been selling at your prices, about seventy cents, and now they write me you have put it down to fifty-five cents.' I told him I did not know, but I thought it quite likely. I believed, however, that he had sold some for fifty-seven and one-half cents. He said yes, but that was some dark, and handed me a sample of it, and then some which he called his best, and, for aught I can see, was like ours, or very nearly so. He handed me a sample of what he said was ours, and which he got, but it was not very neutral, or very handsome. He also said, "You have bought, I hear, Everest's
620 patent. His was an infringement of mine, as I showed him. He came to me and wanted to sell it, but I replied, 'Why should I buy what I already have got?'" I told him I wanted to be candid with him. I did not want to talk with him about it. He could of course see, as anybody else could, Merrill's patent, by getting a copy from Washington. We were selling largely, and thought a good deal of it, and meant to sustain the patent at any cost. We did not buy Everest's patent as any use to us, because he was not making, or did not pretend to make, our article, but we thought so important of our patent, and there was some conflict, we preferred to pay and own, under any contingency, a perfect title; that I had seen his oil sold in Boston, and thought he might by treading on our patent. If so, we should certainly maintain our rights. He said it would be much better to keep it quiet and keep up the price, as, if known how good the oil was, others would infringe and steal it. If we were working superheated steam on a vacuum, we were infringing his patent. That the oil he now made was just what he made from the first, and that he had quietly sold a great deal of it. That it was his custom to send to Washington and get copies of patents, but he had neglected to get a copy of ours, but would get one; and if we were not working superheated steam on a vacuum, then we should go together in price, and quietly sell and not make a noise about it. I told him if he had anything to say, he must go to Boston and say it to you and your brother; that, as I told him, we were selling quite largely, and thought much of it, and felt quite confident our patent would be sustained; at any rate, we should spend any amount to try it. I am myself more confirmed than ever, that he has seen your Washington patent, and is on the same or nearly the same track. The oil he showed me is essentially ours in color, etc., and more neutral than the sample he got for ours, and which I think is some mistake; but as I did not wish to commit myself, I did not very particularly examine it, except to rub it on my hands. He seems very anxious to talk and to come to some mutual agreement or something, which he would not, if he really

had made it from the beginning. I think it will turn out, if you ever know, that he is running paraffine oil instead of crude, now, through his vacuum superheated steam-apparatus." Now there is a little postscript. The postscript is, "He don't seem to offer it in Pittsburg, for nobody here knows that he makes such an oil.'

621 (The foregoing answer being subject to objection.)

Int. 13. State whether or not this letter contains all, or substantially all, that passed between you and the doctor on that occasion in reference to neutral topaz oil; and if you remember anything further that was said on that subject at that time, please to state it.

(Objected to.)

Ans. I think it states, as full as I can now remember; I don't recall anything to my memory. I meant to have written it at the time as full as I could. I think when the doctor said, "If you are making superheated steam on a vacuum," I made this reply: "We are making no oil by vacuum process in our works."

Int. 14. Had you at any time before that interview had any conversation with Dr. Tweddle in reference to his manufacture of neutral topaz oil?

Ans. No, sir; not as neutral topaz oil. I think I never had any conversation with him about lubricating oils; his hobby was to make everything into illuminating oil without alkali or acids. There was of course some naptha and some residuum.

Int. 15. If at any time after this interview in October, 1869, you had another interview with him in reference to the same subject-matter, state where and when it took place, and how it came to take place, and what passed between you upon that subject.

(Objected to.)

Ans. In the spring of 1870, I saw Doctor Tweddle, as appears from a letter written here, at our office in New York. This letter is dated May 9. I think that is a mistake; I was not in New York in May, but I was there in March, and also wrote a letter March 8th to Wm. B. Merrill, which indicates a connection with this letter. March 8th I wrote to William B. Merrill, of which the following is an extract: "I saw Bartlett here from Boston. He says the Tweddle folks told him to sell right on, and they would see him harmless. He says he went on and talked the whole thing over then. He says the business is done in Tweddle's name alone, and his works have cost $250,000, but he considers Lockhart & Frew the principals, but don't know." The next day, as I think,

622 I wrote Mr. Joshua Merrill, which letter I quote as follows: "I wrote William B. that I saw Mr. Bartlett here, and to-day, per appointment, I met Dr. Tweddle alone at our office. Mr. Bartlett told me he wrote the Pittsburg folks of William B.'s threat, and Mr. Tweddle particularly referred to it. He says, on receiving the notice from Mr. B., and he also heard it from other sources, they called a meeting of the parties in Pittsburg with their counsel, laid the whole subject before them, with all the proofs, samples, patents, etc., and the result was an order to their agent to go ahead. He said he did not exactly expect this intimidation, as to a certain extent it hurt them, or did he consider it exactly fair. I told him I thought that had been overstated, as intimidation was not our object, but as we did mean to sustain our patent, if we could, I thought any person selling the same as agent should know. He said they had prepared a communication for publishment in Boston, assuring parties that they might buy their neutral oil with confidence, because they would protect them; that they did not wish a quarrel with us; so told us they felt aggrieved. I told them that we believed they

were violating our patent if we had said so, and I presumed we had. I saw no impropriety in their coming out with a card and saying, as they did not believe they were, they would protect the parties who bought, and had no objection, as far as I was concerned, to their publishing what they wished. I told the doctor we wished him to understand we were willing for both to exhibit their works and their process, and if both were convinced there was no violation, we would harmoniously develope. If he was satisfied he was infringing, we would license for a moderate royalty. If we held a patent we wanted it, and meant to sustain it, if we could. He might go back to Pittsburg and consult, and if we heard nothing from him we would consider silence gave disconsent. When we commenced, it would be on some seller at home, as being more convenient. He replied, declining at once any inspection of the works. He said since he had read our patent he was satisfied we were not, if we worked under them, infringing any of his, but he was not making the same article as us, but better; that he had recently deposited at the Patent-Office samples of all his oils, all ours, and all other people's, for reference; that they were self-evident, and if we went on and saw them we should be satisfied. He thought we had a good patent, but he was not violating it, and I rather understood him to say he took the crude. He talked very large about sales; said their Pittsburg sales he considered as nothing, only about two hundred and fifty barrels per month, but
623 they had just got to work again, and was now doubling, and would have to treble their stills. Wants us to commence against them as principals. I told him I was glad I had seen him, as we wished before we commenced to let him know that we did not aim at any monopoly, but meant to sustain our rights. He replied, he was not infringing, and if we examined we should come to the same conclusion. I told him I preferred to examine the oil sold in Boston to the sample at Washington, and that I had, and I believed he was infringing. That was about all. He said he regretted the expense of a suit, and with us, as it would cost a good deal of money, which he did not want to spend. I told him it was the same with me, but he must not blame us for endeavoring to sustain our rights. Keep this for reference." Now, there is a postcript, as follows: "He also said he had taken out some new patents or details; one, quite important, was a man-hole at the bottom, which was found necessary on large stills, and also on safety-valves. I told him our oldest stills also had safety-valves, and I thought Luther Atwood had a man-hole in his cylinder-still at Waltham, which ventilated the bottoms. He said when he first built for Kier and others he put them both in, and he thought therefore he was first, and the man-hole at the bottom had become necessary for large stills. I leave for Albany to-night or early to-morrow morning?"

THURSDAY MORNING, *March* 7, 1872.

Int. 16. When did your refinery in Corry first go into operation, and how far is it situated from Pittsburg?

Ans. We built it in 1862, and I think it commenced early in 1863; about one hundred and thirty miles, more or less, north of Pittsburg.

Int. 17. State whether or not you manufactured at that refinery, down to 1868, paraffine lubricating oils like those you made in Boston before you commenced manufacturing Merrill's deodorized oil; and if so, in what part of the country were such oils sold.

Ans. We manufactured the paraffine lubricating oils there until the factory closed in May, 1868. The oils were sold principally West, but some in the city of New York and its neighborhood.

Int. 18. Have you had a statement prepared from your books showing the monthly and yearly sales at that refinery during the period you mentioned; if so, will you please produce it?

Ans. At the request of Mr. Joshua Merrill, when I was at
624 Corry, I requested Mr. Murdoch, who was then chief clerk of the works there, to get me an abstract of our sales from the opening to the closing of the factory. He gave me the following extract, which I now produce, to be marked "Exhibit No. 118," and I believe it to be a correct abstract from the books.

Int. 19. When did that refinery commence operations again, and what kind of lubricating oil have you manufactured there since it was reopened, and where has it been sold?

Ans. It commenced operations in January, 1869. We have manufactured the Merrill deodorized oil, the common paraffine oils, and the natural oils. It has been sold in the West and the East, on the line of railroads diverging from Corry. Some in Philadelphia and Baltimore —none in New York City.

Int. 20. How much of the common paraffine oil have you sold since you commenced in 1869?

Ans. Very little compared with the Merrill deodorized.

Cross-examination by Causten Browne, esq., in behalf of the respondent.

Cross-int. 1. I understand that your visit to Pittsburg to attend the convention of oil-dealers in regard to the excise law, was in March, 1868. Is that so?

Ans. March 3d, 4th, 6th, 7th, 8th and 9th, 1868.

Cross-int. 2. (De bene.) In the letter to Wm. B. Merrill, from which you make a quotation in your answer to the 7th direct interrogatory, is the following paragraph contained, viz: "I received yesterday yours of the 4th, and am very much pleased to hear you speak so favorably of Joshua's new lubricator, and hope it will prove all you expect, and that extra exertions will be made to make it go everywhere, for on the successful getting rid of our heavy products, I consider much of our future success depends; but what the new lubricator is, is beyond me, for as yet I have never heard the first word of anything beyond the castor. So tell Joshua to write me about what it is, at Corry, for which, via Oil City, I start this evening."

Ans. Yes, it is.

Cross-int. 3. (De bene.) In answering direct interrogatory 10, viz,
"When and where did you first see the neutral topaz oil, manu-
625 factured, as you understand, by Dr. Tweddle?" what do you understand by neutral topaz oil?

Ans. I understand by neutral topaz oil that there was an advertisement appeared in the paper of his neutral topaz oil. I understood that to be a comparatively odorless oil, oily in its nature, and from which the light ends had been distilled off without falling back into the still, or permanently separated; making a new and useful article of commerce.

Cross-int. 4. In what paper did you see this advertisement?

Ans. In 1869, I think I saw it in the Boston papers. I am not certain, however. It was very freely advertised when the doctor did advertise it.

Cross-int. 5. Do you give the last part of your last answer but one beginning, "I understood that to be," etc., as a description which you found in the advertisement referred to?

Ans. I do not.

Cross-int. 6. You say you think you saw the first sample of neutral topaz oil, as you use that term, in New York. State, if you can, whereabouts in New York.

Ans. My impression is that it was shown to me at our office in New York, but my memory is very indistinct about it.

Cross-int. 7. (De bene.) In the quotation which you made from your letter to Joshua Merrill, dated October 22, 1869, you say, speaking of Dr. Tweddle, "he handed me a sample of what he said was ours and which he got, but it was not very neutral or very handsome." What do you mean here by neutral?

Ans. I mean by "neutral," odorless. Practically, not as a chemist, which I am not, I would divide the smells of lubricating oils into three classes: First, the still smells. Second, the smell after it had been subsequently treated with acids which, when well done, I have called "sweet," and the deodorized smell of the Merrill and Tweddle topaz oil.

Cross-int. 8. What do you mean by the term deodorized smell?

Ans. Neutral, or comparatively odorless.

Cross-int. 9. What do you understand the still smell to be owing to, or do you not know of your own knowledge or judgment?

626 Ans. That is in chemistry, beyond me. I do not know of my own knowledge.

Cross-int. 10. (De bene.) You say in your letter of October 2, 1869, "We did not buy Everest's patent as any use to us, because he was not making, nor did he pretend to make, our article, but we thought so important of our patent, and there was some conflict, we preferred to pay, and own under any contingency a perfect title." What conflict do you here refer to?

Ans. The conflict, sir, as I understand it, was, Mr. Everest got his patent into the Patent-Office at Washington previous to Mr. Merrill, but Mr. Merrill showed Mr. Everest that he had manufactured his article previous to Mr. Everest. These are my impressions. I was not particularly conversant with the business. It was entirely under the control and management of Joshua Merrill.

Cross-int. 11. To return, for a moment, to what Dr. Tweddle showed you as a sample of the Merrill oil which you said was not very "neutral" or very handsome. What odor did it have, and what was the objection to its color?

Ans. The objection to the color would be that as near a light lemon yellow as we could get would be the most desirable. Various batches vary somewhat in color. I paid very little attention to it. I thought the doctor wanted to entrap me into making some mutual agreement about selling both our oils. I remember looking at it, wetting my thumb and finger with it, and smelling it. I cannot recall the shade of color. It seemed to me when I smelt of it after rubbing it with my hands, that it was not as free from odor as the oil usually made by Mr. Merrill, if it was his at all.

Cross-int. 12. Not as free from what odor?

Ans. The odor that distinguishes the common paraffine oils, and which they are comparatively or entirely deprived of by the Merrill and Tweddle process.

Cross-int. 13. When you used the term "neutral" as applied to paraffine oils, do you include freedom from the green or blue tinge, as well as freedom from the characteristic odor of the paraffine oils of commerce?

Ans. No sir; I don't refer at all to the blue tinge.

Cross-int. 14. I wish to call your attention for a moment to the
627 samples which you saw March 7, 1868, at Lockhart & Frew's, one of them (five per cent.) being lubricating oil. Did you observe the gravity, Beaumé, of that oil?

Ans. No, sir.

Cross-int. 15. (De bene.) You say, in one of the letters you have quoted from, speaking of Dr. Tweddle's neutral topaz oil, "He don't seem to offer it in Pittsburg, for nobody here knows that he makes such an oil." Of whom did you make enquiries in Pittsburg on that subject?

Ans. I made enquiries of Mr. Bligh, I think his name is; of another gentleman who manufactured paraffine oils, but whose name I forget; I can ascertain it; I have a poor recollection of names; and in general with Mr. Pemberton, of the salt-works, and other acquaintances in Pittsburg, whose names I do not recollect.

Cross-int. 16. In the percentages mentioned to you March 7th, 1868, as the percentages obtained by Dr. Tweddle, is included three per cent. waste. Were you informed what this waste consisted of?

Ans. No, sir.

Cross int. 17. You say that you were in Pittsburg, according to your diary, in February or May, and in June, of the year 1869. Did you see Dr. Tweddle in either of these visits?

Ans. I cannot answer positively. Quite likely I may have met him. I think I did. February 8th I wrote home to Boston some remarks about Dr. Tweddle, from which I think it is quite likely I saw him.

Cross-int. 18. Why were the works at Corry closed from May, 1868, to January, 1869?

Ans. The works at Corry were owned entirely by myself. They were leased to the Downer Kerosene Oil Company. They wished to give up their interest, and I was not prepared to carry them on alone.

Cross-int. 19. Have you the means of furnishing an account of the illuminating oil sold from the Corry Works during the same period of time that is covered by the account (Exhibit 118) of the sales of lubricating oil?

Ans. I have no doubt that I can. The books of the Corry Oil Works were kept entirely separate, as two distinct works, under the charge of W. H. L. Smith. The books are at Corry.

SAMUEL DOWNER.

628 The complainant, by his counsel, offered a circular, produced and marked "Exhibit No. 118," and defendant's counsel admitted that it was issued after Dr. Tweddle went to Aladdin.

Complainant's exhibit No. 118.—*H. Farnam Smith, special examiner.*

Sales of lubricating oil by Downer Oil Works.

Mar. 1, 1863, to April 30, 1864—14 mos	8,033¼	gallons.
May 1, 1864, to June 30, 1864—2 mos	7,149	"
July, 1864	13,765½	"
Aug., "	838⅝	"
Sept., "	8,256⅝	"
Oct., "	3,366	"
Nov., "	16,539	"
Dec., "	9,075¼	"
Six months	51,841⅛	

Jan'y, 1865		8,022⅜	gallons.
Feb'y, "		11,809⅝	"
Mar., "		13,246½	"
April, "		11,925½	"
May, "		12,385	"
June, "		9,066½	"
July, "		15,036½	"
Aug., "		7,611½	"
Sept., "		14,854⅛	"
Oct., "		19,689½	"
Nov., "		21,360¾	"
Dec., "		8,733¼	"
One year	151,741⅛		
Jan'y, 1866		3,781¼	"
Feb'y, "		10,759	"
Mar., "		7,776½	"
Apr., "		4,474½	"
May, "		17,861½	"
June, "		4,875	"
July, "		14,545½	"
Aug., "		19,438¾	"
Sept., "		25,851¼	"
Oct., "		23,452¼	"
Nov., "		17,749½	"
Dec., "		14,961¾	"
One year	165,527¼		
629 Jan'y 1867		9,114¼	gallons.
Feb'y "		12,463¼	"
Mar., "		15,914¾	"
Apr., "		10,079¼	"
May, "		4,779¼	"
June, "		2,437½	"
July, "		2,733¾	"
Aug., "		5,453¼	"
Sept., "		5,328	"
Oct., "		4,460¾	"
Nov., "		19,096	"
Dec., "		12,044½	"
One year	103,904½		
Jan'y, 1868		5,119¾	gallons.
Feb'y, "		6,692¾	"
Mar., "		7,650¼	"
Apr., "		3,122	"
Four months	22,584¾		

Closed in May, 1868.

Factory closed until January, 1869, and then opened as oil-works.

Deposition of Henry C. Colgate, taken before Levi Gray, notary public, Tuesday, March 12th, 1872.

Direct examination by Chauncey Smith, esq., in behalf of complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Henry C. Colgate; forty years of age; Adrian, Michigan; dealer in soap.

Int. 2. What was your occupation in the years 1868 and 1869?

Ans. The same as at present, but have sold goods outside in addition.

Int. 3. State whether or not during the years 1868 and 1869 you sold any goods for Dr. Herbert W. C. Tweddle, of Pittsburg. If so, state what goods they were.

Ans. I did, sir. In 1868 and 1869 I sold a lubricating oil called Eclipse.

630 Int. 4. Any other kind of oil?

Ans. I had samples of other kinds of light lubricating oils in the spring of 1869.

Int. 5. Will you state about what time in 1868 you commenced selling oils for Dr. Tweddle?

Ans. About March. The first samples I took out to sell was in March, 1868.

Int. 6. Have you any letter from Doctor Tweddle which enables you to fix this time? If so, produce it.

Ans. Yes, sir. (Witness produces letter marked "Complainant's Ex. No. 120.")

Int. 7. State whether or not you afterwards received the samples referred to in this letter; and, if so, what kind of oils they were.

Ans. I did so. They were oils called the Eclipse lubricating oil; a dark oil.

Int. 8. This letter also refers to certificates which will be forwarded in a few days. Did you receive such certificates; and if so, will you produce a copy if you have one, to be marked as an exhibit in the case?

Ans. I did. Here is one. (Witness produces certificate which is marked "Complainant's Exhibit No. 121.")

Int. 9. State whether or not you visited Doctor Tweddle's refinery called Eclipse Refinery, near Sharpsburg bridge, in the spring of 1868.

Ans. I think it was not exactly in the spring of 1868. I visited it several times in the year 1868. I think the first time was in June, 1868. I might have been there in May, but I think it was in June.

Int. 10. State whether or not the doctor showed you about his refinery, and showed you the oils which he had on hand; and, if so, state what kinds of oils you saw and what quantities.

Ans. He showed me through his works; all I saw was two oils. They were a head-light oil, which is a carbon oil, I think, of a test of about one hundred and seventy or one hundred and seventy-five, and the other oil was the Eclipse lubricating oil. There were a large number of barrels of what I thought head-light oil; the brands of the barrels the same as the head-light oil; a large tank which I think had in it the same kind of oil. Then there was a tank filled full of Eclipse lubricating oil; one tank held I should think a hundred barrels or more. I did not see the tank for the head-light oil; only saw the faucet where it was drawn.

631 Int. 11. State whether or not you sold the head-light oil as well as the Eclipse lubricating oil.

Ans. I had samples of that, but sold none.

Int. 12. In what parts of the country did you sell the lubricating oil?

Ans. Cleveland, Chicago, St. Louis, Indianapolis, Dayton, Zanesville, Steubenville.

Int. 13. You spoke of seeing some light-colored lubricating oil at Doctor Tweddle's in 1869. State when and where you first saw such light-colored oil.

Ans. I saw them in his office at 174 Wood street, Pittsburgh.

Int. 14. About what time?

Ans. The spring of 1869. It might have been in January; I was in Pittsburgh then.

Int. 15. State whether or not the doctor afterwards furnished you with samples of such light-colored oils for sale. If so, state about when it was you first received such samples.

Ans. The samples were sent to me in either April or May.

Int. 16. State whether or not, about the time you received the samples, you received a letter from the doctor making reference to them. If so, state as nearly as you can what the date of such letter was, and where the letter now is, if you know.

Ans. The letter was received in the latter part of April or May, stating that he had sent me samples and a price-list of the different kinds of oils he was making. It consisted of a spindle, woolen, neutral, or neutral topaz oil, paraffine, and Eclipse lubricating oil, summer and winter lubricating oil, two kinds. The letter I gave to Dr. Tweddle, and the price-list.

(The counsel for the complainant asks counsel for the defendants to produce such letter in accordance with a notice to that effect, given on the 5th day of March, instant, to the defendants' counsel in Boston, and also all other letters referred to in such notice.

The counsel for defendants replies that he has no such letters and does not know where they are nor who has them; that he had no means of inquiring about or searching for such letters during the brief interval between the giving of such notice in Boston, to his associate counsel, and his leaving Pittsburgh to attend this examination; that he is advised by Doctor H. W. C. Tweddle, who is now present, that he does
632 not know whether he has such letters or where they are, and that he could not go to Pittsburgh at any time since the service of said notice to make search for said letters, owing to the sickness of his wife, who was with him in Boston, and that if on search made such letters can be found, they will be produced.)

Int. 17. Will you state when and where, and under what circumstances, you gave the letter above referred to to Dr. Tweddle?

(Objected to by defendants' counsel.)

Ans. I gave it to him in Pittsburgh; I think it was Monday night, the 26th day of June, 1871, about eleven o'clock at night; between eleven and twelve; about that.

Int. 18. Will you state what was the occasion of your visit to Pittsburgh at that time?

Ans. I went there to deliver these letters to Doctor Tweddle.

Int. 19. State whether or not the doctor sent for you to come then.

Ans. The time before when I was in Pittsburgh the doctor asked me if I could give him the letters at that time, the 26th day of June. Then, Sunday, on the 25th day of June, I received a despatch from the doctor to be there.

Int. 20. State whether or not, at the time you gave the doctor the letter, you gave him any other letters, papers, or circulars, or samples of oil which you had previously received from him.

Ans. I gave the doctor a large share of what I had saved of the correspondence of 1868 and 1869, consisting of letters, price-lists, circulars, and I gave him two samples of oil.

Int. 21. State what kind of oils those samples of oil were and when you received them from the doctor.

Ans. They were light-colored oil. I received them in 1869.

Int. 22. State whether or not they were the first samples of light-colored oil you received from the doctor.

Ans. I couldn't say. I think I recived two samples of light-colored oil, and I could not say whether they were the first or not.

Int 23. State whether or not at the time you gave up the letters and samples to the doctor he had any conversation with you as to testifying as a witness in this case.

(Objected to by defendants' counsel.)

Ans. No, sir.

Int. 24. State whether or not during your visit to Pittsburgh
633 on the twenty-sixth of June last, he had any conversation with you as to testifying as a witness, or as to the time when you first sold his light-colored oils.

(Objected to by defendant's counsel.)

Ans. No, sir; not at that time.

Int. 25. State whether or not after you received the samples of light-colored oil from the doctor you made any sales of such oil. And, if so, when and to whom you made your first sales.

Ans. I couldn't say to whom or when I sold them. If I sold any it was in small quantities.

Cross-examination by William Bakewell, esq., in behalf of defendants:

Cross-int. 1. Was not the reason for your not selling much of Doctor Tweddle's light-colored lubricating oil the high price of that oil as compared with the other lubricating oils that you sold for him?

Ans. It was on account of their being much higher than other light oils used for the same purpose. He claimed a better quality.

Cross-int. 2. What was the name or brand of that light-colored lubricating oil?

Ans. It was called neutral or neutral topaz. He had two or three light oils with different names.

Cross-int. 3. What were the names of those light colored lubricating oils of Dr. Tweddle's other than the neutral or neutral topaz?

Ans. Paraffine oil. I saw samples of different kinds of oils at the doctor's office which he didn't send me, but yet he made them. He may have sent them, but I cannot be sure, I had so many samples sent to me at different times. Their names were paraffine and spindle, and a woolen oil, but I can't say whether that is a light oil or not. It isn't a black or a very dark oil; about medium color, and, in my opinion, I don't class that as a light oil.

Cross-int. 4. By light oil in your last answer you mean light in color, do you not?

Ans. Yes, sir; I mean light in color, not white, such as light yellow.

Cross-int. 5. When you visited Doctor Tweddle's Eclipse Works in the spring or summer of 1868, how many tanks for holding oil did he have?

634 Ans. I never counted them. I know of three that I saw. There may have been five more for all I know of. Three tanks are all I know.

Cross-int. 6. What was the brand on the barrels which you saw, which you supposed to contain head-light oil?

Ans. I didn't read them.

Cross-int. 7. Where were those barrels which you supposed to contain head-light oil?

Ans. On the first floor of the factory.

Cross-int. 8. What kind of oil was it that you sold for Doctor Tweddle during the year 1868?

Ans. Eclipse lubricating oil.

Cross int. 9. What was the name of the samples of light-colored lubricating oils which Doctor Tweddle sent you in the spring of 1869?

Ans. Paraffine oil and a light oil which is used for mixing with other oils. I won't say whether it was a neutral oil or neutral topaz oil. I cannot exactly say the name, I think it was a neutral oil for mixing. Then there was a woolen oil sent me. The mixing oil may have gone by the name of neutral or neutral topaz. The only thing I sold it for was mixing.

Cross-int. 10. Previous to the time when you visited Doctor Tweddle's work' in 1868, had you been engaged in the manufacture or sale of petroleum oils?

Ans. No, sir. I never sold any petroleum oils, only for Doctor Tweddle.

Cross-int. 11. Before your visit to Pittsburgh, in June, 1871, when you came at the request of Doctor Tweddles, as you have stated, did you not see Doctor Tweddle at the house of his counsel, H. Blakewell, and make a statement to him to the following effect, in substance or in words as follows: That in July, 1868, you commenced to sell his heavy paraffine oil, neutral, light yellow, and deodorized; that Doctor Tweddle sent you samples several times; that the first samples were in bottles with paper wrapt around them, and that the next samples were sent in tin boxes; that you sold this oil to several parties; that you didn't know what they bought it for, but that it was sold as a mixing oil?

Ans. Yes. I told them I couldn't tell until I examined my letters. I told them that at that time I wasn't certain whether I sold in 1868 or 1869. Doctor Tweddle tried to impress upon my memory that I
635 sold it in 1868. I told them that when I got home and examined my letters I would tell when I sold it, which I did by answering by telegraph. I mean that the conversation related to light oils. Doctor Tweddle sent me samples several times of different kinds of oil several times in 1868 and 1869. The first samples were the Eclipse lubricating oils sent to me in bottles with paper wrapt around them; that was in 1868. In 1869 he sent me samples of light oil in tin boxes. The first samples that I had sent to me of Eclipse lubricating oil was sent to me in small bottles with paper wrapt around them in boxes. The light oils I may have sold. I never asked what they were going to do with them.

Redirect.

Int. 1. When did you stop selling oil for Dr. Tweddle?

Ans. I don't think I sold much after 1869, and may have sold some 1870.

HENRY C. COLGATE.

Deposition of Joshua Merrill, taken before H. Farnam Smith, special examiner, Thursday, March 28, 1872.

Direct examination by Chauncy Smith, esq., in behalf of the complainant.

Int. 1. What is your name, age, residence, and occupation?

Ans. Joshua Merrill; forty-three years of age; residence in Boston, Mass.; I am an oil merchant, and manufacturer of petroleum oils.

Int. 2. Are you the plaintiff in this case, and have you been previously examined as a witness.

Ans. I am; and have been so examined.

Int. 3. Will you describe generally the changes which take place in petroleum oils when subjected to distillation; and the difference which is found at any point in the distillation, between the product coming over from the condenser, and that which remains in the body of the still?

636 Ans. The petroleum usually is of a dark green color, sometimes almost black, and in some few instances of a yellowish color. The gravities of the petroleum vary from quite heavy, with a thick, viscid body, to a light gravity, very mobile and thin in body. Upon distillation of the lighter gravity petroleums, the first products that come over and are condensed are a light naphtha body, very volatile, with a strong, persistent odor, more penetrating than that of the crude oil from which it is distilled, almost colorless, and very mobile and spirituous. After the naphthas are distilled over, then comes an oil which is classed as illuminating oil, beginning at a gravity usually of from fifty-eight to sixty degrees Beaumé. This oily product continues to distil, usually almost white in color, with a strong, offensive odor, until a gravity of about forty-two Beaumé, is reached, at which degree it begins to turn slightly yellow or straw-colored, and more oily in body. The next products that come over between forty-two and about thirty-six or seven Beaumé are yellow in color, too oily in body for the illuminating oil, not oily enough in body for lubricating oils. It contains slight crystals of paraffine upon a reduction of temperature and is very offensive in odor. The next products, between thirty-six or thirty-seven degrees Beaumé, are still darker in color, growing heavy in body as the distillation proceeds; contains large quantities of paraffine, is disagreeable in smell, and gradually grows dark as the distillation proceeds. It is usually the practice to portion this last described oil for crude lubricating oil, distilling off the portion that comes over between thirty-seven and twenty-eight degrees Beaumé, at which stage of the distillation it grows so dark in color and offensive in odor that it is called "cokings," and it is kept by itself for redistillation to purify it. Distillation proceeds until all the "cokings" are run over, and a coke or solid carbon is left in the still. This description pertains to the light gravity petroleums. The percentages of the described products from petroleum of about forty-five to forty-six Beaumé in gravity would be, first, naphtha about fifteen per cent., the illuminating oil portion from forty-five to fifty per cent.; the portion between forty-two and thirty-six degrees Beaumé, from ten to twelve per cent.; the portion between thirty-six and twenty-eight degrees Beaumé, from twenty to twenty-five per cent.; the "cokings" from three to five per cent. The balance is lost by gas and coke. These percentages are obtained when the still

637 is fired in such a manner as to produce rapid distillation and comparatively small decomposition of the oil undergoing distillation. When the cracking process of distillation is pursued, the illuminating portion of the distilled petroleum may be made to embrace nearly all the portion coming over between forty-two and twenty-eight degrees Beaumé, as described above, that product being cracked up into an oil of light gravity and mobile in body; like the burning oils. In other words, the whole product of distillation, after the napthas are removed, may be made into illuminating oils of about forty-five degrees Beaumé in gravity, like the refined petroleums sold in the market as burning oils.

In distilling the heavy petroleum oils, the gravities of which vary from thirty-six degrees Beaumé to twenty-five degrees Beaumé, very little naphtha is produced, even from that weighing thirty-six degrees Beaumé, and mere traces of naphtha in that weighing heavier than

thirty degrees Beaumé. When distillation begins from these heavy petroleums, the product is illuminating oil, varying in character both as to its color and odor and gravity; that which is distilled from a thirty-six degrees petroleum being lighter in color and gravity, and larger in amount, than that distilled from petroleums heavier than thirty degrees. When distillation is performed rapidly and decomposition is as much prevented as possible, the portion coming over lighter than thirty-eight degrees Beaumé (which is the only portion suitable for illuminating oil) is about from twenty to thirty per cent. from thirty-six degrees Beaumé petroleum, and from fifteen to twenty per cent. from petroleums heavier than thirty degrees Beaumé. The next products that come over heavier than thirty-eight degrees Beaumé are yellow in color, gradually growing darker as distillation proceeds, and heavier in gravity, and of varying percentages, of from fifty-five to sixty per cent. in the case of the thirty-six degrees Beaumé petroleum, and from sixty to sixty-five per cent. in the case of petroleums heavier than thirty degrees Beaumé. Large shrinkages always occur in the distillation of the heavy petroleums, when distilled rapidly and run to dryness or coke in the still, often as much as from fifteen to twenty per cent. less in gas and coke, in the very heavy petroleums I have mentioned. The products can, by the process known as cracking, all be made into illuminating oil, thin in body and of light gravity, in which case the shrinkage is always larger, with more loss in tarry matters, or coke and
638 gases incapable of condensation. The products of distillation are always of a lighter color and a lighter gravity than the product in the still from which it is being distilled, and the odor of the distillate is usually more penetrating, and, in most cases, more objectionable, than the oil from which the distillate is derived.

Int. 4. State whether or not any change takes place in the odor of the oil remaining in the still, as the process of distillation goes on, and what the nature of such change is when it takes place.

Ans. There is a change in the odor of the oil in the distilling vessel as the distillation proceeds. Crude petroleum, with the naphthas removed simply, has a modified odor, less objectionable and less diffusive. As the distillation proceeds and the burning oils are distilled over, the petroleum in the still has a modified odor, growing less and less diffusive and objectionable as the distillation goes on, and when the burning oils are all distilled over, down to about forty degrees Beaumé, the petroleum left back in the still has but a slight objectionable odor. From the removal of the volatile oils, it has increased in oleaginous properties, is heavier in gravity, and but slightly pungent in odor. This is true of the petroleum left in the still, until distillation is carried on so far that offensive odors are generated by a partial decomposition in the still. I will here say that, as the distillation proceeds, the petroleum grows darker in color, losing any transparency it may have had in the crude condition, except when exposed in very thin films upon glass, or some transparent substance.

Int. 5. State how long these changes in the odor of the petroleum in the still, as the distillation progresses, have been known by yourself and to persons generally, engaged in the manufacture of petroleum oils.

Ans. These changes in the odor have been well known to me since 1858, as they relate to petroleum, and I believe they have been well-known facts to all manufacturers of petroleum oils since that time.

Int. 6. Will you state whether the series of products which you have described as being produced in the manufacture of petroleum, and the

various changes in color and odor, are those which are produced by ordinary fire distillation, as it is called?

Ans. They are produced by ordinary fire distillation.

Int. 7. State how those products or changes are affected when the distillation is carried on by the aid of steam, common or super-
639 heated, circulating through pipes immersed in the oil or thrown into the body of the oil so as to pass off with the body of the petroleum vapors, or with the use of a vacuum used in conjunction with fire or steam, applied as I have stated.

Ans. The products of distillation of petroleum, whether distilled by naked fire or by fire and steam, either common or superheated, or by fire and vacuum, or by fire, steam, and vacuum in combination, are substantially the same, until the distillation has progressed to that point where the burning oils which distil over white or nearly white are all distilled over. I speak now in reference to the character of the products distilled over. When the distillation reaches about thirty-eight degrees Beaumé, or when the oil coming over begins to come colored yellow, and from that on, until distillation is completed, there is a difference in the physical properties of the oil distilled over, a difference in the gravity of the oil distilled over, and the products of the distillation are so far modified by the use of steam in connection with fire, and by the use of steam, fire, and vacuum in combination, that the oil distils over more oily in body, with less decomposition or cracking, and but slight differences are observed in the color of the products distilled over.. No perceptible difference in the odor of the oil is observed in those two processes last referred to. The products below thirty-eight degrees Beaumé, when distillation is performed by fire alone, contained more thin oils from decomposition of the petroleum by the action of the fire, than in the case when steam in combination with fire, or steam, fire, and vacuum in combination, are used. When fire and vacuum in combination, without steam as an auxiliary, are used in distilling petroleum, the products of distillation below thirty-eight degrees Beaumé also contain considerable percentages of thin and offensive oils from decomposition of the petroleum undergoing distillation, but not so much as when distilling by fire alone. The products remaining back in the still, if the distillation were carried on until no more oil would come over, would, in every instance, be coke, varying somewhat in quantity under the different processes. If the petroleum was not all distilled over or only the burning oils were distilled off, the petroleums remaining back in the still, up to this stage of the process, would be substantially alike. If the distillation was carried on until not more than from twenty to twenty-five per tent. of the petroleum remained in the
640 distilling vessel, that which was distilled by fire alone would be more dark in color, and with somewhat different odor, and more offensive, than in the case where distillation was performed by the aid of steam, or by steam and vacuum, in which case the petroleum remaining in the still would be more green in color, somewhat like the color of the natural petroleum, and with but slight disagreeable odor.

Int. 8. State whether or not you have ever known distillation to be carried on by fire alone, or by fire and steam, without the production of tar or coke; and, if so, state what the conditions were.

Ans. I have known distillation to be performed upon crude petroleum both by fire alone, and by fire and steam in combination, and have myself manufactured thousands of barrels of petroleum distilled by fire and steam, distilling off, first the naphthas, then the burning oils, continuing the distillation until a gravity of about thirty-eight degrees

Beaumé was reached, when the distillation was stopped, and the oil remaining back in the still was comparatively free from odor, of a thick, viscid nature, when cold, and contained neither tar nor coke, and was an excellent lubricating oil for coarse machinery, and was made expressly for that purpose. This process I carried on continuously for weeks together, in a still from which the oil remaining after the removal of the oils above described by distillation was pumped out, and the still immediately refilled with fresh petroleum, without any cleansing of the still whatever, and at the expiration of several weeks no trace of tar or coke was in the still.

Int. 9. State how the oil remaining in the still in such distillation compared with the dark green lubricating oil which Dr. Tweddle has described in his testimony in this case as one of the products produced by him in his Eclipse Refinery at Sharpsburg bridge, and a sample corresponding to which he has produced in the case.

Ans. It is, in odor, appearance, color, and gravity and viscidity, substantially the same thing.

Int. 10. When did you manufacture this kind of oil?

Ans. I have made it at many various times since 1860, and would state that we made, in 1871, some thousands of barrels that were shipped to the continent of Europe.

Int. 11. State, if you know, whether other manufacturers have been accustomed, since the introduction of petroleum, to manufacture the same article and also in substantially the same way.

641 Ans: I know it has been largely made at the Corry Oil Works, in Corry, Pennsylvania, and I believe that it is a common thing for petroleum manufacturers to produce the article.

Int. 12. Will you state upon what conditions the non-production of tar or coke in the distillation of petroleum depends, and whether or not their non-production is peculiar in any degree to the kind of stills which Dr. Tweddle has described as being used at the Eclipse Refinery at Sharpsburg bridge?

Ans. When the distilling of petroleum by any known process of the application of heat is stopped or suspended, at a point in the distillation before which the oil remaining in the distilling vessel becomes so concentrated that carbonaceous matter separates from it and deposits on the bottom or sides of the vessel, no coke or tarry matter will be formed in the still. The deposition or production of coke or tar depends wholly upon the extent to which the distillation is carried. The stills as described at the Eclipse Works of Dr. Tweddle at Sharpsburg bridge were admirably adapted for carrying on the distillation of petroleum without the formation of tarry matters or coke; as, in the manner described of the working of that apparatus, it would be exceedingly difficult, if not impossible, to carry the distillation on sufficiently far to produce a deposit in the stills of tarry matter or coke, excepting as in the case of the cast-iron still, where the products of distillation were carried to so great a height in the form of vapor before they passed over to the condenser that condensation against the surface of the dome of the still and the consequent falling back into the still of the oils so condensed, and falling upon the heated pipes in the still, would produce decomposition or cracking of the oil, in which case carbon or coke or tarry matter would be deposited upon the dome or inside the still.

Ints. 13. You have spoken of different kinds of petroleum. To what extent have you been acquainted with the different kinds of petroleum used in this country and how do they differ in different localities? Give a description of some of those which are most marked in their distinction from others.

Ans. I have been acquainted from the early discovery of petroleum with most of the different petroleums produced in this country and in the Dominion of Canada, and I would mention among those of
642 marked peculiarities and among the oils known as heavy gravity petroleums first, Mecca oil from Ohio, which is a very heavy gravity oil from twenty-five to twenty-six degrees Beaumé, dark green in color with very slight odor of an earthy character. The West Virginia oil from Kanawha County, known under various names, such as Volcanic oil, Globe Oil, West Virginia lubricating oil—this oil also bland and comparatively sweet in odor having a gravity of from twenty-eight to thirty-two degrees Beaumé. The Franklin oil, so called, of Pennsylvania, having a gravity of from thirty-two to thirty-four degrees Beaumé, also a sweet-smelling oil of comparatively little odor. Also the surface oils, so called, of Oil Creek and vicinity, having gravities ranging from thirty-two to thirty-six degrees, with more odor than those above mentioned. Then the Canada oils of heavy gravity, from twenty-six degrees to thirty-two degrees; also of light gravity, from thirty-two degrees to forty-five degrees, both of which are exceedingly disagreeable in odor, so much as to almost prohibit their carriage about the country until they are manufactured and deprived of their odor. And the Kentucky oils, which are a heavy oil, much like the Canada heavy oil, exceedingly disagreeable. Heavy oils from Colorado, which were brought me by a gentleman to examine in quantities of about three gallons, much like the Kentucky, disagreeable and heavy—most or all of which I have distilled and carefully examined with a view to ascertain their properties and value as oils for distilling purposes. The Smith's Ferry oil, from Ohio, I have worked in hundred-barrel lots to the extent of several hundred barrels. It differs from all other petroleums in the peculiar color it has when pumped from the earth, being of a lightish yellow, sometimes very light; a strong odor and light gravity characterize it also.

Int. 14. Did you hear or have you read the testimony of Herbert W. C. Tweddle, in this case, and also that of Joseph Clark, in respect to certain oil spoken of by Dr. Tweddle in answer to interrogatory 71, which he thinks was produced in Barren County, Kentucky? If so, will you state whether you are acquainted with the oil produced in that region, or with oil having the characteristics of that oil as described by Dr. Tweddle and Mr. Clark?

Ans. I did hear the testimony given by Dr. Tweddle and by Mr. Clark, and have read the same and I am familiar with the petro-
643 leum produced in Kentucky having the characteristics of the oil described by Dr. Tweddle in answer to that question.

Int. Will you state whether you find any fact stated by them in respect to the treatment of that oil, or the products therefrom, which enable you to form a judgment as to whether any part of the products could have been substantially like Dr. Tweddle's neutral topaz oil, or like your deodorized oil, described in the patent on which this suit is founded? If so, will you point out the facts stated by them, which enable you to form any judgment upon that question, and give the reasons for your judgment?

Ans. I find, upon a careful investigation of the process to which they subjected that oil, that, in my judgment, it would be absolutely impossible for him to have produced an oil with the characteristics or qualities like neutral topaz or my deodorized oil. My reasons for forming this judgment are, that, first, in answer to interrogatory 71, Dr. Tweddle states: "I purchased in the fall of 1864 some two or three hundred bar-

rels of petroleum which had a stinking and offensive odor." "In the spring of 1865, I treated this oil in an agitator with sulphuric acid, precipitating a heavy deposit of carbonaceous matter. I then treated the oil with alkali, etc., and distilled the oil by fire and by supersteam. (The crude oil was of very heavy gravity.) The distillate had a very bad odor. I treated it again in an agitator, with sulphuric acid and alkali. I redistilled the oil again by fire and superheated steam. When the oil began to run from the condenser very yellow, I stopped the distillation. The residuum in the still was amber-colored, with very little odor. The distillate had a bad odor, which was only partially removed by another treatment with acid and alkali."

By treating this heavy Kentucky petroleum, in its crude condition, as it came from the wells, with sulphuric acid, the petroleum unites with the acid and forms a compound of acid and oil, which is exceedingly difficult to separae, and after the additional treatment of the acid-treated oil with alkalis, etc., a saponification of the body takes place, which is not separated, except upon the application of very high heats, and even then but partially so. When this oil is placed in a still and, by means of fire or fire and steam, is distilled, the products that go over to the condenser have a disgusting and stinking odor, from the formation of new compounds, owing to the presence of the acids or
644 partly neutralized acids, in combination with the oil. Oil treated in the manner described would give off sulphurous gases at the condenser so strong that it would be almost impossible for workmen to remain in a room where the distillation was being conducted. The oils resulting from this distillation would be very dark in color, and on exposure to the atmosphere would continually grow darker and more difficult of final purification. There would be very large quantities of tarry matter or coke left in the distilling vessel, owing to the action of the acid held in the oil during the high heats of distillation. In the treating of this distillate again with sulphuric acid and alkali, less difficulty would be experienced, as the acids would more readily subside from the oils after treatment than when the crude oil was treated with acid, as stated. In the redistillation of this twice-treated oil, the product remaining in the still, as the distillation progressed, would grow darker and darker in color, and with the quantity remaining in the still, which was stated in answer to cross-interrogatory 58 in the testimony of Joseph Clark, page 442 of the printed record, as follows: "I can't positively say. I judge from eight to ten barrels," it would be a black viscid tar. This would be partially owing to redistilling an acid-treated oil, without the presence of alkali in the still during the process of distillation; it being practically impossible to fully neutralize or remove the acid with which the oil had been treated, by the use of an alkali in the agitator, as described in answer to interrogatory 71. Acids enough remain in the treated oil, in chemical combination with it, to color the oil remaining in the still, when run down to this percentage, very black. If alkalies had been used in the still during the process of distillation, the oil distilling over would have been comparatively free from offensive odors, and the oil remaining in the still, when run down to the quantity mentioned, would have been so united, chemically and mechanically, with the alkali as to have precluded the possibility of its having been like the neutral topaz or my deodorized oil. It is clear, from the statement of the doctor, that the oil resulting from the redistillation had a bad odor, which was only partially removed by another treatment with acid and alkali, that the oil was distilled without the presence of alkali in the distilling vessel. The statement is made that when the oil began

to run from the condenser very yellow on the second distillation, the distillation was stopped, and the residuum in the still was amber colored. This is stated in Dr. Tweddle's answer to direct interrogatory 71, on page 250 of the printed record. Oils distilling over are always lighter in color than the oil remaining in the distilling vessel, and, as I understand amber color, it is lighter colored than very yellow. Oil remaining in a distilling vessel after it had reached the stage where oil was running very yellow from the condenser, would, in the case of redistillation of petroleum oils, be much darker in color than that running from the condenser. This would apply even to the refined burning oils of commerce, which are nearly white in color. I find, in answer to cross-interrogatory 318 of Dr. Tweddle's testimony, page 345 of the record, he says as follows: "All I remember is this: that when I found the still running yellow, and spoiling the distillate already made, I told the distiller or foreman to have the operation stopped." This shows that the oil distilling over at that period was far along in the heavy oils, and was coloring the comparatively white oil, which had been distilled off previously, and shows conclusively that the oil remaining in the still must have been very dark in color, and tarry in its character, and totally unlike the deodorized oil referred to in Tweddle's answer to interrogatory 71.

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Int. 16. Are you able to determine, from Mr. Clark's testimony, what percentage the final product or residuum of the second distillation was of the whole quantity of the crude oil, and also of the quantity introduced into the still from the second distillation? If so, will you state what it was?

Ans. I find that no mention is made, in either Dr. Tweddle's deposition or in Mr. Clark's, of the shrinkage which the oil sustained in the first treatment with sulphuric acid and alkali in the agitator. Neither do they state the actual number of gallons of distillate produced from the first distillation of the acid-treated crude oil. But, from my own knowledge of the shrinkages of heavy oil, like the Kentucky oil, there should not have been more than a loss of one-fifth in the distillation and treatment described. If there were two hundred and forty barrels, as stated by Joseph Clark in answer to direct interrogatory 63, page 423 of the printed record, twenty per cent. loss on the treatment and distillation of the crude oil would leave one hundred and ninety-two barrels of distillate before it was treated with acid and alkali the second time. The second treatment of this distillate would not cause a shrinkage of more than five or six per cent., which would leave one hundred and eighty-one barrels, which was pumped into the still for redistillation. If there were ten barrels of residuum left in the still, as stated by Clark, this would have been a small fraction over five per cent. of the oil placed in the still, and of the crude oil originally used about four per cent.

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Adjourned.

FRIDAY, *March* 29, 1872.

Int. 17. State whether or not the quantity there probably was put into the still at the second distillation could have been, if it had been common burning oil, distilled down to eight or ten barrels, and such eight or ten barrels have the color and qualities attributed to it by Dr. Tweddle and Mr. Clark. What result would you get in distilling the common burning oil down to such a point?

Ans. The refined burning oil of commerce, when distilled down to this percentage, would leave in the still a black and more or less tarry residuum, and would be totally unlike the oil as described in the testimony

of Dr. Tweddle and Mr. Clark, as the residuum left after the second distillation was performed.

Int. 18. Are you able to state, from what is given in the testimony of Dr. Tweddle and Clark, whether or not the material put into the still at the second distillation was as heavy or heavier in gravity than the refined burning oils of commerce; and whether or not the eight or ten barrels of residuum derived from it would or would not have been darker or heavier than that which would be obtained from the distillation of such refined oil?

Ans. I am able to do so from the testimony of Mr. Clark, where he states in his deposition, in answer to interrogatory 68, page 433, which interrogatory is as follows: "In this first distillation was the whole distillant, the heavy and light oil run together?" The answer is, "Yes, sir." The nature of the petroleum was such that there must have been a considerable percentage of the heavy oil mixed with the lighter burning l, and the whole body have been much darker in color, and the residuum remaining in the still after the second distillation must have been more tarry and black than in the case where refined burning oils have been distilled in like manner.

Int. 19. Will you refer to what Mr. Clark says about the removal
647 of paraffine from this oil, by the aid of acids, and state whether or not any such result could have been obtained from the use of acids in the manner he describes?

Ans. Referring to Mr. Clark's testimony, and in answer to cross-interrogatory 35, page 440, which interrogatory reads as follows: "Did you do anything with the illuminating oil as you call it before you redistilled it?" Answer. "It was treated in the agitator with sulphuric acid." In cross 36, the question is asked, "What effect did this treatment have upon it?" Answer. "It still improved the oil." Cross 37. "In what way did it improve it?" Answer. "It took the paraffine out of it." This statement is obviously incorrect, or shows ignorance of the action of sulphuric acid upon paraffine; the strongest acids having no effect upon paraffine itself, and would only serve to remove impurities from paraffine when paraffine is treated with it. Paraffine is unacted upon by the strongest chemical agent. Its name, as stated by Brande, "Is coined from the Latin parum little, and affinis, akin, to denote the remarkable chemical indifference, which is its characteristic feature."

Int. 20. Will you state what effect the presence of paraffine in any lubricating oil has upon its character and how it affects its commercial value?

Ans. When present in quantities which it naturally contains, as distilled from petroleum by any of the known processes of distillation, it is sufficiently abundant to cause the whole mass of the oil with which it is associated to chill up and lose its mobility upon a slight reduction of temperature, and injures the commercial value of the oil to such a degree that at least eight months of the year it would be nearly unsalable. During the very warm weather of summer it may be used, without materially injuring the oil as a lubricator. I will here state that paraffine in and of itself possesses very slight lubricating properties. When thoroughly separated from the oil it is a hard wax. When melted it is as thin as water in body. The temperature at which it melts varies from one hundred and fifteen to one hundred and thirty-five degrees, Fahrenheit. As it approaches the melting-point, it grows plastic, and can be moulded into forms or pulled out in strings like wax.

Int. 21. You have referred to the Smith's Ferry oil as one with which you are acquainted. Will you describe the characteristics of the
648 oils produced from it by your company, or as they have been generally found in the market?

Ans. The crude Smith's Ferry oil is of a light yellow color, light in gravity, and a strong petroleum odor; upon distillation, it yields, first, a considerable percentage of naphtha, generally about from twelve to eighteen per cent.; from forty-five to fifty per cent. of illuminating oils; from twenty to twenty-five per cent. of heavy paraffine oils; balance tarry matters and coke left in the still. When distilled in this manner, the products are almost identical with those obtained from the dark-green petroleum oils of like gravity. If the distillation be stopped, after the naphthas and burning oils are distilled over, down to from thirty-eight to forty degrees Beaumé, the residuum left in the still is of a yellowish color, quite transparent, but darker than the petroleum from which it is derived. This residuum is viscid and oily at low temperatures, has but a slight odor, and is a good lubricating oil for coarse machinery, and it only differs from the heavy green lubricating oil obtained from the distillation of the ordinary crude petroleum in its being lighter in color. It has been sold, so prepared, quite largely in the market, as amber oil.

Int. 22. State how, in its color and odor, this amber oil compares with your deodorized oil, or with the neutral topaz oil of Dr. Tweddle.

Ans. Its odor is so slight that it is practically a deodorized oil. Its color is so light that from these characteristics it would readily deceive one not skilled in the art, as a similar oil to my deodorized oil or the neutral topaz oil.

Int. 23. In what respect, then, does it differ from your deodorized oil or the neutral topaz oil?

Ans. It differs in two essential particulars, the first of which is, it is a residuum of crude petroleum left back in the still after the burning oil has been distilled over, and has never been subjected to distillation or raised in vapor; second, it contains a granular substance, which is probably partially developed paraffine. This substance causes the oil to chill easily, rendering it thick and viscid upon a slight reduction of temperature, and it is impossible to remove this paraffine from the oil, as it refuses, under any known treatment, to assume a crystalline form so that it can be separated by straining through bags or by
649 pressure. For many uses in the arts, it is not applicable where the deodorized oil and neutral topaz oil are very desirable.

Int. 24. In respect to the blue or green tint, which has been spoken of as characterizing the paraffine oils, how does this compare with the neutral topaz or with your oil?

Ans. It has a very decided shade of green with slight blue, and in this respect is entirely unlike my deodorized oil or neutral topaz oil, which has very slight traces either of blue or green.

Int. 25. Will you state what prices it has borne in the market as compared with other residuum oils, or with the common paraffine oils in use before the introduction of deodorized oil and neutral topaz?

Ans. I am unable to state, of my own knowledge. The product is one of comparatively small supply, and has not attracted my special attention as to price.

Int. 26. Will you look at the specimens of crude Smith's Ferry oil, and the residuum of such oils produced by Dr. Tweddle, and marked "Exhibits 62 and 63," and state how they compare with the oils which they respectively represent, as you have been acquainted with them?

Ans. The sample of crude Smith's Ferry, marked "Exhibit 62," is a fair sample of that product, and compares, in my judgment, with the product of those wells. I have seen lighter colored Smith Ferry oil—also darker color—the different wells varying somewhat in these respects. I have distilled several hundred barrels of Smith's Ferry petroleum, and am familiar with it as sold in the market. The residuum of fire and steam distillation of the Smith's Ferry oil, like Exhibit No. 63, compares with products obtained by myself from the Smith's Ferry petroleum after the naphthas and burning oils were distilled over, and those which I have seen in the market, in its color, odor, and general appearance.

Int. 27. You have stated that the residuum of the Smith's Ferry oil contains a substance which is probably undeveloped paraffine, and which cannot be removed from it; and you have also stated that when the distillation of this residuum is continued, a heavy paraffine oil is obtained. Will you state whether or not, in this last distillate, the paraffine is fully developed, and capable of being separated?

Ans. When this residuum is raised in vapor, and distilled over, the oil resulting from that distillation contains large quantities of
650 paraffine, which readily assumes the crystalline form upon the reduction of temperature, and can be easily separated from the oil, either by straining, or by pressure in bags, or any of the usual modes.

Int. 28. How did this last-mentioned oil differ from the other common paraffine oils known in the market before the introduction of your deodorized oil?

Ans. It was identically the same as the common paraffine oils, made from ordinary petroleum, in all its characteristics.

Int. 29. Dr. Tweddle, in his answer to the 148th direct interrogatory, after describing briefly the process described in your patent for producing deodorized oil, says: "The residuum in the still after this process is Joshua Merrill's oil, and is a residuum;" and in answer to direct interrogatory 153, after briefly describing the method in which he produces neutral topaz oil, he says: "My neutral topaz oil is a distillate." Will you state whether or not it is true that while his oil is a distillate your oil is a residuum, and not a distillate?

Ans. My oil in all cases is a distillate; and in order to produce my oil the petroleum from which it is derived must be distilled over in order to separate from it the tarry and coky matters which are developed in the process of distillation, and in order to develop the paraffine in a crystalized form, so that it may be possible to separate it from the oil. There is no known way of separating paraffine from petroleum excepting by the process of distillation, which develops or produces the paraffine in such a form that it may be separated. The oil made by Dr. Tweddle is also a distillate, and cannot be made by any other process than distillation.

Int. 30. In what sense, if any, is your oil a residuum?

Ans. My practice is to place the distillate, after the paraffine has been removed from it, in a distilling vessel and at as low temperatures as possible, to distill off any light thin offensive oils that may be associated with it. The oil, after this operation is completed, remains in the distilling vessel until cooled sufficiently to make it convenient to pump it out into receptacles for holding it. In this sense, it is a residuum.

Int. 31. Refined then to crude petroleum, your oil, then, as I understand it, equally with Dr. Tweddle's, is a distillate, and not a residuum, and has had the tarry and coky matter removed from it, and the paraffine developed by distillation, just as Dr. Tweddle's neutral topaz oil has?

651 Ans. It is, as you understand it, a distillate, and both oils are treated precisely in the same manner, and for the same purpose.

Int. 32. In his answer to direct interrogatory 220, on page 358 of the printed record, Dr. Tweddle says: "The illuminating oil, the paraffine or neutral topaz oil, and residuum can be produced by following the process described in the patent of December 10, 1867, the same as they can by the patent of February 15, 1870, No. 99975," referring to his own patents of those dates. Will you look at the last-mentioned patent and state from it what results the doctor says he does obtain as to oils, and then state whether you find any description or suggestion in the first-named patent that any such results could be obtained by following the process therein described?

Ans. I find, from a careful reading of the patent No. 99975, that Dr. Tweddle describes a mode of distilling petroleum at a comparatively low temperature, produced by free steam, superheated or not, at pleasure, in a vacuum or partial vacuum, with or without fire, on the outside of the still, by which means, he states, he obtains products essentially different in quality and in their characteristics from products obtained where high heats are used in distilling the petroleum. The paraffine oils obtained are described by him as follows: "The oils which in the process described are expressed from the paraffine product are, for lubricating purposes, vastly superior to the lubricating oils produced by the distillation of the tarry residuum of the old process, or if made direct from petroleum by direct fire, though of less gravity, averaging thirty to thirty-five Beaumé, they have a much better body. They have but a slight pungent odor, which is easily and almost wholly removed by a slight subsequent chemical treatment, and have hardly a trace of the blue or the green tint, which is a destructive characteristic and an objectionable feature to lubricating oils made by the ordinary process. The almost entire absence of the blue and the yellow tint and the offensive odor renders this oil, which I have introduced into commerce as neutral topaz oil, much more valuable than the lubricating oils produced by distilling tar or petroleum, or other hydrocarbon, by the first process hereinbefore described, and in general use. The lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way." I find, upon reading letters-patent No. 72126, of December 10, 1867, in the description

652 there given of the method of distilling crude petroleum, no description of the products or process like that pursued in the patent of February 15, 1870, No. 99975.

In the patent No. 72126 he states that the petroleum is allowed to drop upon heated pipes, heated by steam or superheated steam, in a vacuum still. The volatile portions are first distilled over by being made to pass over the pipes in a still, heated to a moderate degree of heat by means of steam, and the portions of this crude petroleum that are not vaporized in this still are made to again drop upon pipes heated hotter than those in the still first named, and that he continues to pass the unvaporized portions of the petroleum from still to still, heated constantly hotter in each stage of the process, as quoted from his patent, as follows: "A current of dry or superheated steam passing in at the valves *xx* keeps such pipes *a* heated to a high temperature. Consequently the drops or streams of oil coming in contact with and passing over them are subjected to the action of a heated surface relatively large, which causes it to volatilize with great rapidity, the more so as the pressure of the atmosphere is already removed from the inside of the still by the air-pump, as hereinbefore stated."

In another place he proceeds in the following words: "The steam used in this process may be admitted into the pipes *a* and *e* of each still separately, or it may at first be admitted into the pipes *a* and *e* of the last and lowest of such stills, and conducted thence by pipes *ii* into the pipes *a* and *e* of the next still, and so on until the last or highest still is reached. In this way I apply the steam, when hottest, to volatilizing the heavier oils, which of course requires for that purpose the greater degree of heat, and as the temperature of the steam is reduced in its passage from still to still, I apply it at a lower temperature to driving off the lighter oils in each higher still; or, in other words, I secure a continuous and complete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier ingredients by a higher degree of heat, passing the residual oil for that purpose from still to still, so as to subject it to a constantly increasing temperature in the successive stills, till only the residuum remains. Superheated steam may, if preferred or found necessary, be used in the pipes *a*, as well as in the pipes *e*." In summing up, he states as follows: "The advantages of this process of distillation are, among others, first, dispensing entirely with the application
653 to the oil of fire, or a fire heat, as already stated; second, a more rapid vaporization of the oil; thirdly, collecting the vapors of the lighter and the heavier oils and condensing them in separate vacuums, whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients which render them dangerous in use at the temperatures to which, in such use, they are necessarily raised; fourth, a continuous and more complete distillation of the oil than can be secured by the ordinary process; fifth, a cheaper process of distillation; and sixth, the production of a better article." In this patent there is no description of such products or oils as are described in the patent of February 15, 1870, No. 99975. The only use of the words "a comparatively low degree of heat" is in describing the distillation of the volatile products that come over before the burning oils.

Int. 33. In this process which you have read from Dr. Tweddle's patent of 1867 what products do you find described as being produced when crude petroleum is the material operated upon?

Ans. There are three products described: First, naphthas; second, illuminating oils; third, residuum.

Int. 34. What kind of oils is the term "refined oil" applied to, as commonly used by manufacturers and dealers in petroleum oils?

Ans. It is applied to burning oils exclusively.

Int. 35. In the patent of 1867 I find this language: "Unrefined, fire-distilled oil has a disagreeable odor and a bad color, to remove which, the oil is generally treated with acids, alkalies, etc. My process of distillation obviates the necessity of refining the oil, with a consequent saving of time, trouble, and expense, and also produces an article superior in quality to the common fire-distilled refined oils." What do you understand to be referred to by the terms "refining the oil?"

Ans. I understand it to relate to the chemical treatment of the oil for the purpose of removing the disagreeable odors generated in the process of distillation, and for the purpose of bleaching the oil to a standard of color required to make it merchantable. The odors removed by this chemical process are those peculiar to burning oils, as they come over from the still and are condensed in the condenser, and do not relate to the inherent odors of the oil, which are a part of its distinguishing characteristics, and are always associated with it in its

654 refined condition, much the same as the odors of alcohol or spirits of turpentine are peculiar to that classes of bodies.

Int. 36. Following the passage I have last quoted from the patent of 1867, I find this statement: "I also apply my improved process to the distillation of the residual and lubricating oils produced by fire distillation, with the same benefits as above set forth." Will you state whether the heavy paraffine oils which come under the term "residual and lubricating oils," as they are commonly distilled by fire distillation, possess the same odors which in the burning oils it required chemical treatment to remove; and whether they required the same chemical treatment to remove them which the burning oils did?

Ans. The odors which characterize the heavy paraffine oils distilled from petroleum by fire heat are somewhat different in kind, but are like the odors pertaining to the burning oils, generated by the action of the heat to which the oil is subjected during distillation, and they require the same chemical treatment to remove them as do the burning oils; and, like the burning oils, readily yield those odors to the action of the chemicals. The oils, after chemical treatment, have their own characteristic odors, the same as do the burning oils.

Int. 37. Assuming that the doctor, in applying his process described in this patent to the heavy lubricating oils, had accomplished in respect to them what he claims to have accomplished in respect to the burning oils, viz, that he had obviated the necessity of refining the oils with acids and alkalies, and had secured by his process of distillation the results of the chemical treatment, the necessity for which he thereby obviated, would he have thus produced an oil like neutral topaz, or your deodorized oil, free from those volatile oils which had before characterized the heavy paraffine oils, and which were irremovable by chemical means?

Ans. He would not have produced neutral topaz oil, or my deodorized oil, but the product would have been an oil with the general characteristics and associated odors of volatile oils that are present and are associated with the heavy paraffine oils refined with acids and alkalies, such as were common in the market before the introduction of my deodorized oil.

Int. 38. In the 181st direct interrogatory, Dr. Tweddle is asked "what he means by the term 'residual oil,'" in the passage I have
655 last quoted, and he answers, "By residual oils I mean those oils which run from fire stills (whether steam or superheated steam is used as an auxiliary or not) at the latter end of the distillation. Do you understand, from this statement and from the remaining part of the answer, what the oil is which the doctor says he referred to by the term "residual oil?" If so, state whether such oil is a distillate or a residuum.

Ans. I understand him to refer to a heavy paraffine oil that is distilled over from crude petroleum at the latter end of the distillation of that oil, for he states as follows: "The oils are yellow, of heavy gravity, from thirty-four to thirty-eight degrees Beaumé, and contain more or less paraffine, and that it is a distillate, and not a residuum."

Int. 39. Will you state whether the term "residual oil" is commonly applied to that kind of oil by manufacturers and dealers in paraffine oils?

Ans. It is not. The commercial term, as applied to that product, is heavy oil or heavy paraffine oil.

Int. 40. Will you state whether you find in the same patent the term "residual oil" used in any other connection? If so, state whether in

such cases you can determine from the connection whether it is used as describing an oil which is a distillate, like that to which the doctor says he applied the term.

Ans. I do find several instances in the patent of 1867, where he describes the process of distilling crude petroleum oils, a reference made to residual oils, which oils are passed from still to still upon pipes heated hotter and hotter, and distilled over, till only the residuum remains. These residual oils evidently refer to that portion of the petroleum left back in the stills which has not been vaporized or distilled over. I quote from the patent of 1867, as follows: "The petroleum to be distilled, either crude or deprived of the gasoline or other more volatile ingredients, and either cold or in a heated state, as may be deemed advisable, is admitted through a cock *b*, at the side of the still B, into a pipe *b*, which running transversely across over the troughs *a*, discharges through a perforation over each such trough, as shown in figure 2, the oil into such perforated and serrated troughs *a*, through the perforations in each trough *a*, the oil runs down, gathers on the points of the serrated edges *c*, whence it falls on to the steam pipes *a*, dropping or running
656 from pipe to pipe, and passing in a thin film over the surfaces of such pipes." "By the use of these devices, the lighter or more volatile oils are driven off in the first still B, in the form of vapor, which being carried over by the goose-neck B1, to the condenser B2, is there condensed, as presently to be described. Such of the heavier oils as are not thus vaporized in the still B, fall to the bottom of the still, whence by a pipe *f*, they are conducted into the next still C. There they are discharged into perforated and serrated troughs *a*, flow on to and over pipes *a*, and other volatile ingredients are driven off in vaporous form, by an increased degree of heat received therefrom and from the superheated steam which escapes from the jet holes in the pipes, in the manner already described. The residuum with the oils not yet volatilized, if any, falls to the bottom of the still C, whence it is conducted to another still and similarly treated, or by a pipe, *f*, is discharged into a receiver D, in which a vacuum is also preserved." "In this way I apply the steam, when hottest, to vitalizing the heavier oils, which of course require for that purpose the greater degree of heat." "I secure a continuous and complete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively lower degree of heat, the next heavier ingredients by a higher degree of heat, passing the residual oil for that purpose from still to still, so as to subject it to a constantly increasing temperature in the successive stills, till only the residuum remains." I quote again: "It is not absolutely necessary that one still should be higher than another, since, by creating a more complete vacuum in the second still than in the first, and so on in each successive still, the residual or unvaporized oil in the bottom of each still may be forced into the next at the same or a higher level."

Int. 41. You have stated, in substance, that you find in the patent of 1867, referred to, no description of an oil like the neutral topaz oil described in the patent of 1870, and no suggestion or statement that such a product could be produced by the process described in the patent of 1867. Will you now state what peculiarity in the process is set forth in the patent of 1870, as distinguishing it from prior processes, and then compare it with the patent of 1867, and state whether you find in that patent any description or suggestion that the same peculiarity or novelty applies to the process there described?

Ans. As I understand the patent of 1870, the process consists mainly in the distillation of petroleum "with the comparatively low heat, pro-

duced by free steam, superheated or not, in a vacuum or partial vacuum, with or without fire on the outside of the still." I quote again from this patent, as follows: "The crude petroleum or other hydrocarbon having first been deprived of its lighter ingredients, such as gasoline, benzine, etc., by steam distillation or otherwise, is admitted into a vacuum still, of such construction as to permit the vapors of distillation to flow over freely or be drawn over so that they shall not condense before leaving the still. By a perforated pipe, or in other suitable manner, I admit steam (common or superheated) into the body of the still, keeping up at the same time by suitable appliances a partial or nearly complete vacuum. In connection with the steam heat a moderate fire may be applied to the outside of the still in any of the ways known to the art. The process of distillation is carried on till from thirty-eight to forty-eight per cent. of the crude material is driven off, which being condensed gives illuminating oil as a product, at which point the distillation shows a gravity of about thirty-seven or thirty-eight degrees Beaumé. The contents of the still will then have a gravity of from twenty-eight to thirty-five degrees Beaumé and contain a large percentage of paraffine. The distillate is then drawn off into another receiver. The distillation is then continued with a comparatively low heat so that the heavier ingredients of the oil shall not be decomposed, but being vaporized shall pass over freely, or be drawn over into the condenser. The process is carried on as long as any yield of paraffine vapor can be obtained. It will be found that the condensed product becomes richer and richer in paraffine as the distillation goes on. The condenser must be kept warm while this is going on, or the paraffine will solidify and clog the apparatus." "After the distillation is finished and paraffine ceases to come over, the residuum will be found to contain very little paraffine." "The oils which in the process described are expressed from the paraffine product are, for lubricating purposes, vastly superior to the lubricating oils produced by the distillation of the tarry residuum of the old process, or if made direct from petroleum by direct fire. Though of less gravity, averaging from thirty to thirty-five Beaumé, they have a much better body. They have but a slight pungent odor, which is easily and almost wholly removed by a slight subsequent chemical treatment, and have hardly a trace of the blue or
658 green tint, which is a distinctive characteristic and objectionable feature of lubricating oils made by the ordinary process." "The lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way."

Adjourned.

SATURDAY, *March* 30, 1872.

Answer resumed:

From this description it is apparent that great reliance was placed upon the distillation of the oil at low temperatures, particularly referred to as being used when the distillation had proceeded sufficiently far to develop the heavy paraffine oils. The language of the patent is as follows: "The distillation is then continued with a comparatively low heat, so that the heavier ingredients of the oil shall not be decomposed, but, being vaporized, shall pass over freely, or be drawn over into the condenser." Whilst in the patent of 1867, in describing the distillation of the heavier oils, he states as follows: "I secure a continuous and complete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier

ingredients with a higher degree of heat, passing the residual oil for that purpose from still to still, so as to subject it to a constantly increasing temperature in the successive stills, till only the residuum remains." In each description, that of 1870 and that of 1867, a vacuum is described as being used, but in the one case, that of 1870, a low degree of heat is described as being used; whilst in the other, that of 1867, a high and constantly increasing degree of heat is described, as the distillation proceeds. The process described in the patent of 1870, as compared to the process of distilling petroleum ordinarily in use, draws the same distinction between the two processes, viz: in the one case distilling from a low heat, and in the other, viz, the ordinary process, by high and destructive temperatures produced by fire-heat. I quote from his patent of 1870, as follows: "Since the early history of oil distillation, a fire heat of high temperature has been commonly applied to the outside of the still."

Int. 42. I find in the patent before referred to, of 1867, this statement, among others, of the advantages to be gained by the use of
659 the process described in that patent: "Third, collecting the vapors of the lighter and heavier oils, and condensing them in separate receivers, whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients that render them dangerous, in use, at the temperatures to which in such use they are necessarily raised." State whether or not in a series of stills arranged as described in this patent, with a separate condenser to each, the oils condensed therein would differ in gravity, and in which one of the series, if either, an oil would be produced "for illuminating purposes, perfectly free from the volatile ingredients which render them dangerous at the temperatures to which, in use, they are ordinarily raised."

Ans. The oils produced in these stills, which are condensed in the separate receivers, would vary in gravity, and the illuminating oil, free from volatile and dangerous ingredients, would be produced in the second of the series of stills as described; or, in the last of such series, if more than two were used.

Int. 43. State whether or not the ordinary paraffine oils, as they have been found in the market for years past, have ever contained volatile oils to such an extent as to render them dangerous, or to render their removal for that reason desirable.

Ans. They never have.

Int. 44. In his answer to the 221st interrogatory, on page 358 of the printed record, Dr. Tweddle, after stating in his previous answer that neutral topaz oil, among others, can be produced by following the process described in his patent of 1867, the same as they can by his patent of 1870, says that the same results described in his patent of 1867 can be produced by following the process and using the apparatus described in his patent of November 26, 1866, being a re-issue of the original patent No. 34324, dated February 4, 1862. Will you state whether or not you find on the re-issued patent of 1866 referred to any description or suggestion that such an oil as neutral topaz oil is produced by following the process therein described?

Ans. There is no such description or suggestion in the re-issued patent of 1866.

Int. 45. I find in this new issued patent of 1866 this statement: "The quantity of illuminating oil thus produced from a given amount of crude petroleum is greater by twelve or fifteen per cent. by my
660 process." Will you state whether or not this indicates that the

heavier oils which would otherwise form the heavy paraffine oils are cracked or decomposed, so as to form this additional amount of illuminating oil?

Ans. It does indicate the cracking of the heavy oils into illuminating oil, as this additional percentage can be obtained in no other way.

Int. 46. In the patent of 1870, which has been referred to, I find the following statement: "Previous to the date of my invention, the efforts of oil manufacturers were chiefly directed to securing the largest possible percentage of illuminating oil, in which oil the presence of paraffine was objectionable. Since the early history of oil distillation, a fire heat of high temperature has been commonly applied to the outside of the still. When from forty-five to sixty per cent. of the oil was thus distilled over, the distillate marked forty-three or forty-four Beaumé hydrometer, and was yellow in color and objectionable in odor. In order to obviate these objections various devices were adopted, such as high domes, goose-necks, etc., the immediate object being to decompose the heavier oils which contained the paraffine, and prevent them from passing over into the condenser, as a result of which change the product was made lighter both in gravity and color. By the use of such appliances, the vapors of the heavier oils which contain the paraffine are condensed in the dome or goose-neck, and fall back into the still when they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless, and a part forming carbides of hydrogen, or other non-condensable gases and water, and another portion being precipitated or adhering to the sides or top of the still as solid carbonaceous matter. The residuum left in the stills as the result of such process of distillation (of which residuum the carbonaceous matter last referred to forms a large part) amounts to from three to ten per cent. of the oil distilled, and which sometimes exists in a tarry mass, or may be reduced to a coke." And after some further description of the oils produced, I find this additional statement: "My improved mode of producing paraffine and lubricating oils is, as a process, directly the reverse of that above described."

661 Will you state whether this process described by Dr. Tweddle as the reverse of his improved process is or is not that commonly known as the cracking process; and, if so, whether the description, as far as it goes, correctly describes the cracking process and the proper construction of stills for ensuring the cracking of the oil?

Ans. The process described as the reverse of his process is the process known as the cracking process of distillation, and the means said by Dr. Tweddle to be employed, and the apparatus described for carrying on that process of distillation, are those usually adopted in this method of distillation.

Int. 47. Dr. Tweddle, in the passage I have quoted, speaks of "high domes, goose-necks," etc., which had theretofore been employed for condensing the heavier oils, and preventing them from passing over into the condenser. How high commonly have such high domes been used when such results were required, including the height of the still itself?

Ans. The height of the dome usually has been from five to six feet above the top of the still, the distilling vessels themselves varying in depth according to the judgment of the manufacturer or builder, and commonly the diameter of the still is considerably in excess of the height. Stills of small capacity are sometimes constructed, having a diameter of from six to eight feet, and a height of from four to five feet, with a dome upon the top of the still from four to six feet in

height and from eight to twelve inches in diameter. A charge of from one thousand to fourteen hundred gallons is usually run in such stills. Stills of larger capacity have more recently been employed, and a common size is twenty feet in diameter by ten to twelve feet in height, on the top of which is placed a dome or goose-neck of from six to eight feet in height, from two feet to two feet and a half in diameter. Twenty thousand gallons, or five hundred barrels, is a common charge for stills of this description, filling the still usually from two-thirds to three-quarters of its actual capacity when full. Much larger stills have quite recently been erected, holding from one thousand to three thousand barrels at a single charge, all of which are arranged with a diameter as compared to their height proportionally greater as the capacity of the still is increased. The goose-necks upon these large stills rarely exceed two feet and a half to three feet in diameter, or eight feet in height. Stills such as I have described are usually run by fire-heat, and all the products after the naphthas are distilled over are converted into illuminating oil.

662 Int. 48. Have you examined the description given by Dr. Tweddle of a cast-iron still erected and used by him at Sharpsburg bridge in 1867, and have you ever examined the still itself? If so, will you state how it corresponds with the description given by Dr. Tweddle in his patent of 1870, as being used for the decomposition of the heavier oils, and how also it corresponds with stills commonly used for decomposing or cracking such oils?

Ans. I have examined both the description of that still given by Dr. Tweddle in his deposition and have examined the still itself. I found the still to be of the dimensions and general construction as described by Dr. Tweddle. In comparing it with stills of about the same diameter as ordinarily used for the purpose of decomposing the heavy oils by the cracking process, I find its height is much greater in proportion than in those stills commonly used when that process is carried on; the height of the cast-iron still, as described by Dr. Tweddle, being from twelve to fourteen feet, whilst the diameter of the still was only from ten to eleven feet. In the ordinary stills, where the diameter would be from ten to eleven feet, the height would not exceed six or seven feet. The height of the dome also above the still and its diameter was greater than was commonly used upon stills of that diameter.

Int. 49. State whether or not, in your judgment, the construction of this still was such as to be favorable to or to ensure the cracking of the heavy oils distilled in it.

Ans. Its construction was exceedingly favorable for the destructive distillation of the heavier oils into illuminating oils.

Int. 50. In Dr. Tweddle's patent of 1870, I find this statement of the results attained in stills having high domes and goose-necks: "By the use of such appliances, the vapors of the heavier oils which contain the paraffine are condensed in the dome or goose-neck, and fall back into the still, where they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless, a part forming carbides of hydrogen, or other non-condensible gas and water, and another portion being precipitated or adhering to the top or sides of the still as solid carbonaceous matter." Did you in your examination of that still find any evidence that any of those results had attended the distillations which had been carried on in that still?

663 Ans. I did find in the dome of that still a dry carbonaceous matter adhering to the sides in considerable quantities, showing

that condensation of the vapors had taken place on the inside of the dome, and from their redistillation and decomposition had deposited the coke or carbonaceous matter upon the sides of the dome, as described in Dr. Tweddle's patent of 1870. I also found tarry matter at the bottom of the still, at a small orifice or pipe-hole through which the residuum, after distillation had been performed in the still, was withdrawn.

Int. 51. In Exhibit No. 75, which has been introduced into this case, and which purports to be an account of the working of what I understand was that still, on a particular occasion in 1867, I find this statement of the trial, which I read, as corrected, in the following exhibit: "At 2.05 p. m. crude oil forty-three degrees gravity was introduced into the apparatus, and steam turned on. In four minutes, the refined oil made its appearance, and in seven minutes was running a copious stream. About fifty barrels was introduced by 3.30 o'clock, and at seven o'clock p. m., or five hours' time, seventy-four per cent. of refined oil was produced, and twenty-two per cent. of lubricating oil." And in answer to cross-interrogatory 154a, Dr. Tweddle states that the proportions of illuminating and lubricating oils given in the passage I have quoted, are correct. Will you look at the exhibit I have referred to, and what Dr. Tweddle says of that trial, on pages 319 and 320 of the printed record, and state whether you are able to say what kind of lubricating oil that was, whether paraffine oil or a residuum oil, such as the doctor in several places has spoken of as his "dark-green lubricating oil?"

Ans. It was a residuum oil, and was his dark-green lubricating oil, to which he has made reference in several instances in his deposition.

Int. 52. Are you able to state, from the density of the petroleum oil used on that occasion, and from the relative quantities of refined and lubricating oil obtained, whether or not the distillation, as then carried on, involved the cracking of the heavy oils?

Ans. I am able to state that it would have been impossible to have obtained the percentage of illuminating oil mentioned, viz, seventy-four per cent., from crude petroleum of forty-three degrees gravity, without cracking to a large extent the heavy oils. The proportion of lubricating oil mentioned might readily have been obtained when the cracking process had been carried on sufficiently to produce the per-
664 centage of illuminating oil, as stated in Exhibit No. 75. I will here state that there would have been obtained, by distilling crude petroleum of forty-three degrees gravity, where distillation was so conducted, that cracking of the heavy oil did not take place, from six to eight per cent. of naphthas, and from forty to forty-six per cent. of illuminating-oil. When this quantity of naphtha and illuminating-oil had been distilled over, heavy oil, yellow in color, would have begun to run over from the condenser.

Int. 53. State whether or not, in your judgment, it would have been practicable on that cast-iron still used in the manner which Dr. Tweddle has described in his deposition, to carry over the heavy oils to the condenser without cracking, or in such a manner as to produce a lubricating oil free from volatile bodies like neutral topaz oil.

Ans. I believe it would have been impossible to distil petroleum in the method described by Dr. Tweddle as carried on in the cast-iron still, without so much decomposing the heavy paraffine oils that they would contain, when distilled over, considerable percentages of thin and volatile oils, and the product resulting from such distillation would, in this respect, be entirely different from neutral topaz oil, and contain more thin and offensive oils than petroleum distilled by the ordinary process of fire distillation.

Int. 54. Will you look at what is said by Dr. Tweddle, in answer to cross-interrogatory 45, and in answer to cross-interrogatories 74 to 79, inclusive, where he describes two modes of using that cast-iron still, as he generally used it, and state whether or not you can determine in which of these two ways, if either, the distillation was conducted, of which an account is given in Exhibit 75?

Ans. In his answer to cross 45, page 303 of the printed record, he says, "sometimes the oil was introduced into the still continuously, and dripped over the pipes as long as we desired." "We have, on a few occasions, charged the still more rapidly until the still was half full, but we still continued the distillation." In answer to cross 74, page 307, he answers: "It was designed to be used for distilling by trickling down over the pipes, or if I chose so to do, by allowing the still to partially fill up and continue distillation." In cross-interrogatory 75, it reads as follows: "In your answer to cross-interrogatory 45, I understand you to speak of two modes in which the still was used. Did you then
665 speak of the two modes just referred to? He answers, "We used the still in the two modes referred to, and in other modes." The question being repeated, the witness says, "They are." Cross-interrogatory 76 is as follows: "Did you obtain the same resuls when you used it in one mode as in the others?" Answer. "We did." Cross-interrogatory 77 says, "When you allowed the still to partially fill up in the last mode referred to in your answer to cross-interrogatory 75, did you fill it up so as to cover the whole or a part of the tubes through which the steam circulated in the still?" He answers: "I think only a part of the tubes." Cross 78 reads: "In such case did you introduce petroleum continually till the distillation was stopped, or did you continue the distillation after you stopped introducing petroleums." He answers: "In such case, when we get the still filled up, we might either continue the distillation with the oil stopped coming in, or we could, and used to, draw the heavy oil from the bottom of the pan into the vacuum receiver, by slightly lowering the vacuum in the still, and increasing the vacuum in the vacuum receiver, until we had drawn a portion or the whole of the heavy oil into the vacuum receiver, then increasing the vacuum in the still and lowering the vacuum in the vacuum receiver, we again opened a connection between the vacuum receiver and the still, and sucked the oil into the still, and redistributed it by means of the troughs over the pipes. This could be repeated over and over again, as long as the operator deemed it necessary. We did, in fact, use it in both of these ways at discretion." In the next cross, 78a, it reads as follows: "In your answer to the 75th cross-interrogatory, you say you used the still in the two modes referred to in that cross-interrogatory and in other modes; what were the other modes?" He answers: "What I meant by other modes—I used it in other modes for experiments, not here necessary to mention." Cross 79 is as follows: "Perhaps you may think it unnecessary, but I desire to know what those modes were. Will you please describe them?" He answers: "The experiments I speak of, the minutes of which I don't recollect, had nothing to do with the question at issue, and I decline to answer. The two modes I have described were those which I used with that still in regular practice. The only other mode which I neglected to mention was, when we filled the still up at once with petroleum, the same as in ordinary fire distillation, first distilling off the light oil, then
distilling off the paraffine oil until the operator deemed the
666 charge sufficiently low. By light oils I mean illuminating oils."

From these questions and answers, and from the description as given in Exhibit No. 75, I am enabled to determine that in this experi-

ment of distilling petroleum the crude petroleum was allowed to run in quite rapidly until the still was partially filled, when the further introduction of crude petroleum was stopped, and the distillation of oil in the still proceeded.

Adjourned.

MONDAY, *April* 1, 1872.

Int. 55. Will you state whether or not, in the process described in the patent of 1870 for producing neutral topaz oil, the crude petroleum is introduced into the still in a mass, from which the illuminating oils are first distilled, and then the heavy paraffine oils, from which the neutral topaz oil is obtained, leaving in the still finally a residuum of tarry matter or coke?

Ans. The petroleum is introduced into the still in mass, and the products distilled off in the order of their volabilities or gravities, first, the burning oils, then the heavy paraffine oils, until only the tarry residuum or coke remains in the still.

Int. 56. Will you state whether or not this is the method described in Dr. Tweddle's patent of 1867, for introducing the petroleum into the still, and conducting the distillation?

Ans. It is not. In the patent of 1867, the petroleum is introduced continuously, and allowed to drip over the heated pipes in drops or thin films, whilst the distillation proceeds.

Int. 57. State whether or not there is any suggestion in the patent of 1870 that the peculiar arrangement of pipes described in the patent of 1867, and the method of introducing the oil there described, is necessary or desirable for producing the results described in the patent of 1870.

Ans. There is not.

Int. 58. I find in the patent of 1870 this statement, relating to the distillation of the heavier ingredients of the oil after the contents of the still (those from which the neutral topaz is obtained) have reached a gravity of from twenty-five to twenty-eight Beaumé. "The distillation is then continued with a comparatively low heat, so that the heavier ingredients of the oil shall not be decomposed, but, being vaporized, shall pass over freely or be drawn over into the condenser. The proc-
667 ess is carried on as long as any yield of paraffine vapor can be obtained." What would be the character of the contents of the still when the distillation had reached a point at which there ceased to be any yield of paraffine vapor?

Ans. There would remain in the still at this stage dry coke. Paraffine vapors always continue to come over freely from the distillation of the heavier portions of petroleum, so long as any oil remains in the still, or until distillation ceases.

Int. 59. Is the method which is described in your patent upon which this suit is founded, for superheating the steam, one which is essential to the production of the deodorized oil?

Ans. It is not. Steam may be superheated in any manner, or it may be used free as it comes from the boiler, the results in either method of using steam being precisely the same.

Int. 60. State whether or not, in the apparatus described in Dr. Tweddle's patent of 1867, the temperature of the still, where superheated steam is admitted into the pipes and into the body of the still itself, and with the aid of a vacuum apparatus, must necessarily be lower than when a fire-heat is used in the ordinary manner.

Ans. It would not necessarily be lower.

Int. 61. Suppose the steam to be superheated to such an extent as to heat the pipes red-hot where the steam enters the still, how would the

temperature of the still in such case, even with the aid of a vacuum apparatus, compare, in your judgment, with the temperature of the still, when heated in the ordinary way by fire?

Ans. I think it would be hotter, for the reason that, when fire is applied to a still containing a regular charge of petroleum, the temperature of the still cannot exceed the temperatures of the oil vapors being carried over, whilst in the case where the pipes were heated by steam where it entered the still sufficiently hot to make them red, the temperature of the still would be much above the temperature necessary to distil the petroleum.

Int. 62. State whether or not the vapor above the oil, in ordinary fire distillation, can have a temperature above the boiling-point of the oil, at the several stages of the distillation; and whether or not such temperatures would be equal to that of steam hot enough to heat iron pipes red-hot.

668 Ans. The vapor could not be above the boiling-point of the oil while undergoing distillation. It is in fact always lower in temperature than the oil from which it is raised in vapor, and would be much below the temperature of iron heated red-hot.

Int. 63. In answer to direct interrogatory 114, I find this statement made by Dr. Tweddle, of the manner in which he manufactures his neutral topaz oil: "I introduce crude petroleum, which has been deprived of naphtha, into a vacuum still heated by superheated steam, with or without auxiliary fire. I distil over the burning oil, first with superheated steam. I then continue the distillation until the gravity of the distillate is thirty-eight Beaumé. I then run the distillate into another tank until the paraffine is distilled over. Sometimes I stop the distillation before the paraffine is all distilled over." State whether or not this statement implies that a charge or mass of oil is introduced into the still, from which the lighter oils first, and the heavier oils afterward, are distilled, leaving a residuum either entirely deprived of paraffine oils or partially so, and whether this statement of the manner of producing the neutral topaz oil is substantially like that described in the patent of 1870 and unlike the process described in the patent of 1867.

Ans. This description involves putting a charge of petroleum in mass in the still, and the process of distillation and the products distilled over are substantially those described in the patent of 1870, and entirely unlike the process or the products described in the patent of 1867.

Int. 64. In answer to interrogatory 124, Dr. Tweddle describes the manner in which he says he produced neutral topaz oil, from June to September, 1857, as follows: "I introduced crude petroleum, which had been deprived of naphtha, into a vacuum still, and with the aid of superheated steam, distilled off burning oils and heavy paraffine oils with very little odor, leaving a residuum which contained neither tar nor coke." State whether or not this statement, like the preceding one referred to in the last question, involves the introduction of a charge into the still and the distillation of the lighter and heavier oils from such charge.

Ans. It does.

Int. 65. In answer to cross-interrogatory 79, I find this statement, also of a method in which Dr. Tweddle used the cast-iron still in the summer of 1867: "The only other mode which I neglected to mention was, when we filled the still up at once with petroleum, the same
669 as in ordinary fire distillation, first distilling off the light oil, then distilling off the paraffine oil, until the operator deemed the charge sufficiently low." State whether or not this method of using the still is the same as that described in the two answers from his direct examination to which I have just called your attention.

Ans. It is the same as that described in the two answers referred to.

Int. 66. In the last statement, Dr. Tweddle speaks of that mode of filling the still as being the same as that used in ordinary fire distillation. Will you now state whether or not you do not find in the patent of 1870 that the production of neutral topaz oil, when this mode of filling the still and conducting the operation is used, is dependent upon peculiar conditions of temperature at which the distillation is conducted, as distinguished from modes practised before that time?

Ans. It is, as stated in the patent, dependent upon peculiar conditions of temperature, at which the distillation is carried on, viz, comparatively low heat.

Int. 67. Were you acquainted with the oil while it was upon the markets, which has been spoken of by several witnesses as the Maysville oil and did you receive from one of the witnesses, William M. Bailey, jr., in compliance with a request made when he was under examination, a sample of such oil?

Ans. I was well acquainted with the oil referred to, when it was in the market, and I did receive from Mr. William M. Bailey, jr., a sample of this oil.

Int. 68. State whether or not the oil, as you knew it in the market, or the sample which you received from Mr. Bailey, was substantially like the deodorized oil described in your patent?

Ans. It was not, and is not.

Int. 69. Will you produce a sample of the oil which was furnished you by Mr. Bailey, as an exhibit, and state how such oil and the Maysville oil, as you knew it in the market, differs from your deodorized oil?

Ans (Witness produced bottle of oil, marked "Exhibit No. 121," and said:) This is a sample of the oil furnished me by Mr. Bailey, and is a fair sample of the Maysville oil, as it existed in the market. It differs from my deodorized oil, first, in being much thinner in body; second, in its having a strong disagreeable odor, and it contains considerable percentages of thin and volatile oils.

670 Int. 70. State whether or not you furnish your deodorized oil to the Lawrence Manufacturing Mills of Lowell, the Pemberton Mills of Lawrence, and the Methuen Mills of Methuen. If so, state how long you have supplied each of them; to what extent you have supplied them, and what use they make of the oils, if you know.

Ans. We have supplied those mills mentioned with my deodorized oil, and have sold the Lawrence Manufacturing Company of Lowell, for the past year, about three thousand gallons. The Pemberton Mills have begun to use it quite recently. I think we have sold them only four hundred gallons. The Methuen Mills we have sold to for some five or six months last past, they usually ordering from six to ten barrel lots at frequent intervals. The oil is used either alone or compounded with sperm oil, by all these parties, throughout their entire machinery.

Int. 71. Have you been acquainted with the lubricating oil manufactured and sold by Merriam & Morgan, of Cleveland, or their predecessors? If so, will you state how it corresponds with or differs from your deodorized oil; and if you know the price at the present time, will you state it, and also the present price for your deodorized oil?

Ans. I am acquainted with the oil made by Merriam & Morgan. It differs from my deodorized oil, first, in having a strong, disagreeable odor; second, in having considerable percentages of thin and volatile oils; and third, in having a deep green and blue shade of color, from which my oil is free. Its price in the market is from thirty-two to thirty-five cents per gallon, whilst the price of my deodorized oil is from fifty

to fifty-five cents per gallon, varying according to the size of the lots sold, the lowest price being fifty cents.

Int. 72. Have you had an application from Merriam & Morgan for a license to manufacture your oil? If so, state when it was made.

(Objected to.)

Ans. I have had an application from Merriam & Morgan for a license to manufacture my deodorized oil, made in June, 1871, in which they write as follows:

CLEVELAND, O., *June* 17, 1871.

Mr. MERRILL, Esq.,
Supt. Downer Kerosene Oil Co., Boston, Mass.:

DEAR SIR: We suppose you are authorized to grant licenses to remove the light ends of paraffine oil by superheated steam or other-
671 wise. If so, will you state the rate of royalty at which you will grant us said license, said royalty to be deposited with a third party, or satisfactory bonds to be given by us for its payment, to be paid over upon the successful issue of your suit with Tweddle, sustaining your right to said process or product, but which royalty shall be forfeited in case you fail in said suit.

Yours, resp'ly,

MERRIAM & MORGAN.

Adjourned.

Cross-examination by Causten Browne, esq., in behalf of the defendants:

Cross-int. 1. What experience have you had in the distillation of paraffine oils in a vacuum?

Ans. I have distilled paraffine oils in a vacuum still several times; the apparatus being constructed and arranged for the purpose of practically testing the distillation of petroleum in this manner.

Cross-int. 2. When did you do this, and where?

Ans. In the summer of 1870, at the works of the Downer Kerosene Oil Company, in South Boston.

Cross-int. 3. Will you please describe, giving dimensions, the apparatus which you so used, as nearly as you can?

Ans. I used a cast-iron still four feet internal diameter, thirty inches in height at the side, a dome one foot in height, covering the still. The still was also saucer-shaped at the bottom, the depression being six inches from a true line. This still was placed over a furnace-fire; the sides were bricked up about two-thirds the height of the still. The dimensions of grates under the still were about two feet six inches square, or five feet of grate surface; the pipe through which the vapors, as they were formed passed from the still was about six inches from the top of the dome. The size of this pipe was two inches, internal diameter, and connected directly with a copper condenser, beginning two inches in size and ending one and one-quarter inches in size, internal diameter. The length of this condenser was about eighty feet, being in spiral form. The end of the condenser was connected upon a copper chamber eighteen inches in diameter and about twelve inches in depth,
672 being nearly hemispherical in form, with a flat cover of cast iron, the whole representing nearly a half globe. From the bottom of this copper chamber was a two-inch outlet, connected by means of a pipe to the suction side of an air-pump. The pipe led from the forcing side of the air-pump to a receiving vessel. There was a vacuum-

guage attached, through the flat cover of the copper chamber, communicating directly with the interior. There was also in the distilling vessel a coil of steam-pipe passing back and forth across the bottom of the still, the united length of which was about twenty-five feet, the internal diameter two inches. This pipe was of iron. The still held readily two hundred gallons at a charge. A thermometer of high range was placed in the vapor-pipe at a point nearest the still practically to be obtained, for the purpose of noting the temperature of the vapors at the various stages of distillation. The steam that was used during the process of distillation was so far superheated as the temperature of the oil undergoing distillation in its passage through the coil immersed in the oil in the still would superheat it, the heat being applied to the oil by means of a fire underneath the still. The steam in the coil was at the boiler-pressure, and during the process of distillation, when admitted into the oil in the still in the form of open steam, or plunged into the body of the oil, it came up through the top of the still, and its inlet into the still was governed by means of a valve placed between the end of the coil and the pipe for admitting open steam into the still.

Cross-int. 4. Please state how you conducted your operations with this still, what oil you introduced, describing the process as you conducted it from beginning to end.

Ans. I placed in the still one hundred and forty-eight gallons of crude Pennsylvania petroleum, from which the naphthas had been removed by steam distillation. The gravity of the petroleum was forty-three and a half degrees Beaumé, at sixty degrees Fahrenheit, after the removal of the naphtha. After putting on the steam-plates and making the still secure and perfectly air-tight, I started a moderate fire under the still, and also, by means of the steam-coil in the still, assisted in raising the temperature of the oil, so far as the steam would do so. At the same time I started the vacuum-pump, exhausting by this means the atmosphere from the still until I had an indicated vacuum by the gauge of about twenty-two inches of mercury, or eleven pounds nearly, atmospheric pressure in excess upon the outside of the distilling apparatus.

673 After the lapse of a sufficient time to raise the temperature of the oil in the still to between two and three hundred degrees Fahrenheit, slight traces of a light burning oil began to pass though the pump, and the vacuum increased to twenty-five inches. At this stage I introduced a very slight jet of steam, partially superheated, into the body of the oil, when distillation at once began, and proceeded with constantly increasing temperatures, as indicated by the thermometer in the vapor-pipe. The gravity of the oil was taken at intervals of five gallons, and the temperature of the vapor noted at the same time, until the distillation was completed. After the burning oil, which distilled over white or nearly white, had all been distilled over, and the gravity of the distillate marked thirty-seven degrees Beaumé, the distillate was carried to another receiver. The distillation was continued after the gravity of thirty-seven degrees Beaumé had been reached, under the influence of an increased quantity of steam, the steam being increased as the distillation progressed, by opening the valve wider that controlled its inlet. Distillation was continued until the oil distilling over showed a gravity of about twenty-eight degrees Beaumé, at which point in the distillation it became very dark in color, with an empyreumatic odor, and the process was stopped, by first withdrawing the fire from under the stills, then by shutting off the direct steam, and finally by stopping the air-pump, allowing the vacuum gradually to become vitiated in the still, by means of a very small petcock in the cover before referred to.

Cross-int. 5. What was the quantity of the heavy oil, from thirty-seven down to twenty-eight Beaumé, which you obtained by the operation you have described?

Ans. Thirty-five gallons.

Cross int. 6. What was the character and quantity of the residuum?

Ans. The residuum was of a dark-green color, very viscid and cohesive when cooled to the temperature of the atmosphere in the summer time; it had a slight odor, and was in quantity about twenty-six gallons. The gravity of the residuum was about twenty-seven and one-half degrees Beaumé.

Cross-int. 7. Did you carry the distillation any further in your experiments with this still?

Ans. I did only in one instance, until the gravity of the dis-
674 tillate, being pumped from the condenser, indicated twenty-five and a half degrees Beaumé.

Cross-int. 8. Did you take any paraffine from the oil which you obtained by these operations?

Ans. I did.

Cross-int. 9. Did you take any paraffine from any oil coming over at a gravity from twenty-five to twenty-seven Beaumé?

Ans. From that special fraction I did not. The distillate from thirty-seven to twenty-five-and-a half Beaumé was all run together and chilled, and the paraffine removed from the average of the oil distilled as specified.

Cross-int. 10. What was the character and amount of the residuum when you carried on your distillation far enough to obtain from the condenser an oil showing twenty-five-and-a-half degrees?

Ans. In quantity there was left about from eighteen to twenty gallons in the distilling vessel. It was so very viscid that it was difficult to measure it with accuracy. It was a very dark green in color, almost black. It had but little smell.

Cross-int. 11. Was there any coke in it?

Ans. No, sir. There was no separated coke.

Cross-int. 12. In manufacturing your patent deodorized oil, is the oil which is left in the still after the removal of the light oils the same color that it is when put into the market?

Ans. That of the unbleached oil is precisely the same color. The bleached oil, sometimes called "L. 29," has received a slight chemical treatment of acid and alkalies, for the purpose of removing the brownish shade which is imparted to the oil when undergoing the deodorizing process.

Cross-int. 13. What is the source or cause of the brownish shade?

Ans. A slight scorching of the oil due to the temperatures to which it is raised during the deodorizing process.

Cross int. 14. Do you use, in any stage of the manufacture of hydrocarbon oils, animal charcoal?

Ans. I do not.

Cross-int. 15. Is any used for any purpose in the Downer Kerosene Company's Works?

Ans. Only for experimental purposes, where it has been used since 1856, at various times, and on every class of oils.

675 Cross-int. 16. From whom do you buy it?

Ans. The last I had I did not buy, but a barrel was presented me by the Continental Sugar-House, at South Boston.

Cross-int. 17. You speak, in your answer to the eighth direct interrogatory, of a residuum lubricating oil for coarse machinery, which you

made from crude petroleum. What was the crude oil which you worked upon? Where did it come from?

Ans. The ordinary Pennsylvania crude petroleum, of from forty to forty-seven gravity.

Cross-int. 18. Did you ever produce any hydrocarbon lubricating oil which contained no paraffine?

Ans. I have produced large quantities of heavy hydrocarbon oil from asphaltums and from rosins which contained no paraffine, and from petroleum, so called, produced in California.

Cross-int. 19. Did you ever procure any containing no paraffine from Pennsylvania petroleum?

Ans. If you mean a heavy hydrocarbon oil, distilled from Pennsylvania petroleum, in that case I answer no. But some of the petroleums of Pennsylvania produce comparatively small amounts of paraffine when subjected to distillation.

JOSHUA MERRILL.

Deposition of William Atwood, recalled for further cross-examination, taken before H. Farnam Smith, special examiner, Tuesday, April 2, 1872.

Cross-int. 4 I understand you to say that in the cracking process, as you have described it, the cracking is effected by the condensation of oil vapors against the comparatively cool surface of the top and sides of the still. Is this correct?

Ans. I did not mean to be so understood.

Cross-int. 5. In what respect does what is described in my question differ from what you understand to be the operation of cracking?

676 Ans. I understand cracking to be accomplished by distillation, and not by condensation.

Cross-int. 6. Is it by the condensation of the oil vapors against the top and sides of the still that the precipitation of the heavier portions, so that they may be redistilled and cracked, is accomplished.

Ans. It is.

Cross-int. 7. In stills constructed for distillation from petroleum, as you have seen them, is the interior surface of the top and sides of the still covered or ceiled over in any way?

Ans. I have never seen the interior of the top or sides covered, but the exterior I have.

Cross-int. 8. Do you mean the exterior of the still, covered by a jacket fitting the still, or simply the still roofed over?

Ans. I mean the still covered by a jacket of brick-work or cement; also the stills are in some cases covered and in others uncovered by a roof.

Cross-int. 9. In the ordinary construction of stills in which the cracking-process is to be practiced, is the iron of the still jacketed, either on the inside or the outside?

Ans. It depends wholly upon the size of the still and its exposure to the atmosphere and the capacity of the heating apparatus, whatever it may be.

Cross-int. 10. Assuming the still to be under a roof, and having a free circulation of air around it, is it usual to have the still jacketed, either on the inside or the outside?

Ans. It is usual to have it jacketed on the outside for a portion of its height, depending somewhat upon its height.

Cross-int. 11. Do you refer to the jacket extending from the bottom

line of the still upwards, to a greater or less height, along the sides of the still?

Ans. I do, along the sides and top of the still?

Cross-int. 12. What I want to know is, whether in the usual construction of stills, as you have seen them, for petroleum distillation, where the still is under cover, but with a free circulation of air around it, any portion of the top and sides of the still is left not jacketed; and, i' so, about how much of it is left?

677 Ans. I have seen stills when wholly under cover completely jacketed over their entire surface. I have also seen stills with three quarters of their entire surface (being the upper portion) uncovered; and all degrees of covering between the two. I have also seen movable coverings for a portion of the sides of stills. All these stills were used for cracking, to a greater or less extent. The more common practice, however, is to have about as much surface uncovered and exposed to the air as is exposed to the action of the five, the uncovered portion being the upper portion.

Cross-int. 13. Ordinarily, what proportion of the entire exterior of the still should you say was exposed to the fire?

Ans. Ordinarily about one-fifth. More one-fifth to one-quarter in small stills. In larger ones from one-third to one-half; one-half only applying to cylindrical stills when set horizontally.

Cross-int. 14. Will you state right here what is the capacity of a still which would be called in the trade a small still, and what that of a large still.

Ans. The capacity of a small still is from fifteen to twenty-five barrels, and of a large still from three hundred to three thousand barrels.

Cross-int. 15. For the purpose of cracking to the greatest extent, is it ordinarily better to have the top and a portion of the sides of the still left unjacketed; and, if so, why?

Ans. It is, because condensation so much the more readily takes place and the cracking is more rapid.

Cross-int. 16. Does the introduction of steam, together with the fire-heat, for distillation diminish in any degree the cracking operation, other conditions being equal?

Ans. It does.

Cross-int. 17. Why?

Ans. Because it forms a vehicle for transporting the vapors out of the still at a lower temperature than they would otherwise be removed under. By vehicle for transportation of the vapors I refer to that property of all vapors and gases whereby they commingle in all proportions, those vapors having a low boiling-point, or permanent gases, tending to prevent the condensation of vapors from high-boiling-point liquids at the same temperature at which they would be condensed if free from such volatile vapors as gases.

678 Cross-int. 18. If I get your meaning, the introduction of steam creates a current of vapor which mechanically carries over oil vapors which would otherwise not go over. Is that correct?

Ans. It is not fully correct. The introduction of the vapor of a lower boiling-point liquid allows the vapor from a high-boiling-point liquid to diffuse itself through it in amount depending upon the temperature until the boiling-point of the high-boiling-point liquid is reached, when they may commingle in any proportion.

Cross-int. 19. Does the amount of paraffine produced from a given

charge of oil diminish as the cracking increases, other conditions being the same?

Ans. If you mean the amount of paraffine separated as such, it does diminish as the cracking increases.

Cross-int. 20. As a rule, is the amount of crystallizable paraffine obtained greater as the distillation is more rapid?

Ans. It is.

Cross-int. 21. At about what temperature of the oil, using fire-heat, is cracking accomplished?

Ans. At about six hundred to six hundred and fifty.

Cross-int. 22. Is the lower stratum of oil, that which is nearest the fire, hotter than the upper stratum at which vaporization is taking place?

Ans. It is not sensibly so. Vaporization is taking place so rapidly as to produce ebullition.

Cross-int. 23. You mean assuming fire-heat only to be used?

Ans. Yes, sir.

Cross-int. 24. What is the melting temperature of lead?

Ans. About six hundred, I think; perhaps as high as six twenty.

Cross-int. 25. Can you give the melting temperatures of cast-iron and of wrought-iron?

Ans. I cannot from memory of cast-iron. Of wrought-iron it is not well ascertained what the melting temperature is. It is, however, greater than that of cast-iron.

Cross-int. 26. At what temperature does water boil in a vacuum?

Ans. It is a little rising one hundred Fahrenheit. The precise temperature I do not recollect.

679 Cross-int. 27. Do you know, or can you form a satisfactory judgment, as to the temperature at which hydrocarbon oil of say thirty-eight Beaumé gravity would be vaporized in a vacuum?

Ans. Hydrocarbon oils of thirty-eight Beaumé gravity have boiling-points varying from one to two hundred degrees, when exposed to the ordinary pressure of the atmosphere, which would be diminished from forty to one hundred degrees, and perhaps in some cases a little more, when subjected to a vacuum.

Cross-int. 28. Taking hydrocarbon oil of thirty-eight Beaumé of average boiling-point, do you know, or can you form a satisfactory judgment, as to the temperature of the oil at which vaporization will take place?

Ans. Vaporization will take place so as to produce ebullition at about four hundred Fahrenheit, at the ordinary pressure of the atmosphere, the temperature increasing very rapidly as vaporization takes place.

Cross-int. 29. I intended to assume in my question that the distillation was in vacuo. Can you answer as to that?

Ans. I should infer at about seventy degrees lower temperature.

Cross-int. 30. The temperature required for vaporization increases, I suppose, as the gravity of the oil in the still increases, while the distillation is going on?

Ans. It does.

Cross-int. 31. In distilling with a vacuum, do the vapors pass away to the condenser with much greater rapidity than when distilled under atmospheric pressure?

Ans. Vapors under a vacuum expand very much, so that the amount of vapor necessary to fill a given space while under a partial vacuum is very much less than the amount required when under the ordinary pressure of the atmosphere. Consequently, if a given amount in weight

is to pass out of a still under a vacuum in a given time, it will have to pass correspondingly more rapid than it would if under the ordinary pressure of the atmosphere.

Cross-int. 32. What is the ordinary area of condensing surface (supposing it to be of wrought-iron and cast-iron respectively) of an eighty barrel still, working practically a charge of sixty barrels, and distilling by fire-heat?

Ans. Practice varies almost as greatly as the number of stills
680 constructed, there being no fixed portion of condensing surface, so far as I am aware, of either material; the amount of surface depending almost wholly (after reaching very moderate limits) upon the supply and temperature of the water used for cooling the condenser.

Cross-int. 33. Would a condensing surface of one hundred and fifty feet, surperficial feet, be enough for such a still as is supposed in the questions, used, as then supposed, taking off the charge at the ordinary rate of running, and supposing the condensers to be kept properly supplied with water, say from fifty to sixty degrees of temperature?

Ans. It would answer a very good purpose, but it is rather a small amount of condensing surface if the oil is desired to be cooled, as well as condensed.

Cross-int. 34. Would the rapid escape of the current of vapors in distilling with vacuum tend to carry over with it portions of oil imperfectly vaporized?

Ans. No, sir.

Cross-int. 35. Would not this take place if free steam was at the same time injected into the still?

Ans. Not unless free steam was injected in such quantities as to produce frothing, or such violent mechanical action therein as to throw over particles of oil or drops of oil undistilled.

Cross-int. 36. You never saw distillation of hydrocarbon oils actually practised in a vacuum still, I believe, did you?

Ans. I never have.

Cross-int. 37. Referring to your answer to the 13th interrogatory, page 556, of the record, if oil dropped upon the surface of the pipes should be decomposed by the high heat to which it would be submitted, would carbon be deposited on the surface of the pipe?

Ans. Not necessarily so.

Cross-int. 38. What would prevent it?

Ans. The excess of oil not decomposed would remove it, or keep it in combination in a liquid form.

Cross-int. 39. In the cast-iron still used by Dr. Tweddle, referred to by you on pages 556 and 557 of the record, what do you understand to be the distance from the top of the highest of the steam-pipes in the series to the entrance of the goose-neck?

681 Ans. From my recollection of the description of the still, from fifteen to eighteen feet.

Cross-int. 40. I mean the height from the uppermost steam-pipe of the series, to the top of the dome of the still?

Ans. From eight to eleven feet. The descriptions that I have heard given of the construction of this still were only given to me during the previous examination, and I am uncertain as to the whole height of the body of the still; but, if my recollection is correct, the body of the still was about fourteen feet in height, and the uppermost steam-pipe about three feet from the bottom, leaving about eleven feet from the uppermost steam-pipe to the top of the dome or still.

Cross-int. 41. What do you understand to be the same measurement in the wrought-iron stills afterwards put up?

Ans. The wrought-iron still, which I suppose you refer to, is of a different construction from the still above described, being a cylindrical still, and set horizontally, of a diameter of about ten feet, if my recollection serves me, and a length of fourteen feet or upwards; the length may have been somewhat greater, say twenty; but at any rate the length was considerably greater than the diameter, the steam-pipes running lengthwise of the cylinder, furnishing a still of very much less height in proportion to its heating surface or distilling capacity.

Direct examination resumed:

Int. 10. In such stills as you have spoken of as small stills, what is the usual proportion between the diameter of the still and its height, and what the height and size of the dome?

Ans. The height is usually about two-thirds of the diameter. The height of the dome, from one-sixth to one quarter of that diameter of the still, in all cases, having the total height less than the diameter, with perhaps a very few exceptions.

Int. 11. Will you give the ordinary dimensions and proportions of stills, say of the capacity of eighty barrels; and also of such as you call large stills, of a capacity say of from three hundred to three thousand barrels?

Ans. Stills that I have seen of the capacity of from eighty to one hundred barrels have usually been cylindrical, and set horizon-
682 tally, with diameters varying from six to twelve feet, with a length sufficient to give the capacity. I have seen a few stills, with a capacity of about five hundred barrels, cylindrical in shape, about ten feet in diameter and about ten feet in length, set upright. These stills were without domes, with a few exceptions in the case of the horizontal stills. The stills of larger capacity, that is from five hundred barrels in capacity and upwards, have been flat-bottomed, or comparatively so, with circular sides, and a height of from six to twelve feet, with usually a dome or cylindrical column upon the top of the same, though this is not always the case. In some cases, the pipes leading to the condensers are connected directly to the top of the still. The domes vary in size, both as to diameter and height. The extreme height, I should think, was not over ten feet, and extreme diameter, six. More commonly, the diameter is from two to three feet, with a height from six to eight. The diameter of these larger stills varies from twenty to thirty-two feet.

Int. 12. Are such stills as you have described adapted to be used for cracking oils?

Ans. They are.

Int. 13. In distilling heavy paraffine oils, when the oil commences to run very yellow from the condenser, what will be the color and character of the oil remaining in the still? By heavy paraffine oils I mean the heavy oils obtained from the first distillation of petroleum.

Ans. From a dark brown to a brownish black, or if there has been much cracking during the distillation, perhaps a full black.

WILLIAM ATWOOD.

Complainant's exhibit No. 120.—*L. G., examiner.*

PITTSBURG, *March* 21, 1868.

HENRY C. COLGATE, Esq.:

DEAR SIR: The samples have both gone forward. Will send you in

a few days printed certificates. Am a little afraid that it is too cold to introduce it yet.

Yours, very truly,

HERBERT W. C. TWEDDLE.

683 *Complainant's exhibit No.* 121.—*L. G., examiner.*

ECLIPSE PETROLEUM REFINING WORKS.

Non-explosive illuminating oil, signal-light oil for railroads and steamers.

These oils are offered to the public as the safest, best, petroleum oils made, photometrical test proving them superior to any oils hitherto manufactured. They will not smoke the chimney, grease the outside of lamps, or create a disagreeable odor in a room, as all oils which are refined by the use of acids and chemicals do, and will burn the deepest lamps dry without crusting the wick. No one need hesitate about burning these oils, as they are all submitted to the severest tests before leaving the works.

BENZOLE, GASOLINE, RHIGOLINE.

Manufactured by steam in vaccuo, under patents granted to Dr. H. W. C. Tweddle, producer of the celebrated Eclipse lubricating oil in use on all the railroads, iron-mills, machine-shops, saw-mills, etc., in the vicinity of Pittsburgh, and proved to be superior and more economical than any lubricator in use; absolutely free from water, grit, gum, or other impurity; will stand the greatest heat without change.

Read the following certificates:

PITTSBURG, PA., *March* 9, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: We have used your "Eclipse lubricating oil" in our rolling-mills and both our gas-pipe mills since last fall, and are satisfied that it has more "body" and lubricating qualities than any of the petroleum lubricators, either natural or manufactured, we have hitherto used.

Yours, respectfully,

SPANG, CHALFANT & CO.

684 PITTSBURG, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: For the past six months we have used your "Eclipse lubricating oil" in our planing and saw mills, and find it superior in every respect to any oil we have hitherto used, which has been principally No. 1 lard-oil.

Our planing-machines run from 3,200 to 4,000 revolutions per minute, and the journals are kept perfectly cool by oiling them twice daily, and are so clean and free from gum that in future we shall use your oil exclusively.

Respectfully, yours,

ROBERT HILL.

PITTSBURG, PA., *March* 9, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: You ask us to give our written opinion of your "Eclipse lubricating oil" for railroad use, which we do with pleasure.

After thoroughly testing it, we are perfectly satisfied that it is the most economical lubricator in use, and entirely free from all impurities.

We have lately examined a number of our car-boxes, and never had them in as good a condition before. After having used West Virginia and all other kinds of oils, we find yours ahead, and equal to the far-famed Mecca oil, and in future shall use no other kind.

Respectfully, yours,

ARMSTRONG, DICKSON & CO.

PITTSBURG, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: We have been using your "Eclipse lubricating oil" since last summer in our different coal-works, and are satisfied that it is a very superior lubricating oil, being entirely free from grit, water, or other impurity. Its quality and cheapness ought at once to render it a favorite with railroads.

We have one hundred and thirty cars on the Pennsylvania Railroad and Pittsburg & Connellsville Railroad; eighty-five on the Allegheny Valley Railroad, and about two hundred pit-cars; and a recent examination of the car-boxes has proved them to be in the very best condition.

685

Yours, respectfully,

CHAS. H. ARMSTRONG.

PITTSBURG, *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: During the past half year we have used about forty barrels of your "Eclipse lubricating oil" at our coal-works, and on our coal-cars, and we never had any oil to equal it as a lubricator while its cheapness and purity commend it very favorably to our notice.

Respectfully, yours,

DICKSON, STEWART & CO.

PITTSBURG, PA., *March*, 1868.

Dr. HERBERT W. C. TWEDDLE:

DEAR SIR: Since last fall we have been using your "Eclipse lubricating oil," and after subjecting it to the severest test, we are as well satisfied with it as that of the best lard-oil.

The machinery of our planing and saw mills is all rapid running, our circular saw making nearly 4,000 revolutions per minute, and yet the journals are kept cool and free from "gumming."

Yours, respectfully,

M'KEE & DOUGLAS.

HERBERT W. C. TWEDDLE,
Pittsburg, Pa.

(Works at Sharpsburg bridge; office, No. 349 Liberty street.)

686 UNITED STATES PATENT-OFFICE.

Herbert W. C. Tweddle, of Pittsburg, Pennsylvania. Letters-patent No. 99975, dated February 15, 1870. Improvement in the manufacture of paraffine and paraffine oils.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Herbert W. C. Tweddle, of the city of Pittsburg,

in the county of Alleghany, and State of Pennsylvania, have invented a new and useful improvement in the manufacture of paraffine and paraffine oils; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the distillation of petroleum or other hydrocarbon oils, which can be made to yield a considerable percentage of paraffine; and consists in so carrying on the process of distillation that little or none of the paraffine will be decomposed, but most or all of it will pass over as vapor and condense in the distillate, from which it may then be separated by cold and pressure.

Previous to the date of my invention, the efforts of oil manufacturers were chiefly directed to securing from the crude oil the largest possible percentage of illuminating oil, in which oil the presence of paraffine was objectionable.

Since the early history of oil distillation a fire heat of high temperature has been commonly applied to the outside of the still. When from forty-five to sixty per centum of the oil was thus distilled over, the distillate marked 43° or 44° Beaumé hydrometer, and was yellow in color and objectionable in odor. In order to obviate these ob-
687 jections various devices were adopted, such as high domes, goose-necks, etc., the immediate object being to decompose the heavier oils which contained the paraffine, and prevent them from passing over into the condenser, as a result of which change the product was made lighter both in gravity and color.

By the use of such appliances the vapors of the heavier oils which contain the paraffine are condensed in the dome or goose-neck and fall back into the still, where they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless, and a part forming carbides of hydrogen, or other non-condensable gases and water, and another portion being precipitated or adhering to the sides or top of the still as solid carbonaceous matter. The residuum left in the stills as the result of such process of distillation (of which residuum the carbonaceous matter last referred to forms a large part) amounts to from three to ten per cent. of the oil distilled, and which sometimes exist in a tarry mass, or may be reduced to a coke.

If this residuum be distilled rapidly by fire-heat in large quantities, it will produce oils from 43° gravity down to 24° or 20° Beaumé, which oils, when chilled and submitted to pressure, yield from eight and one-half to twelve pounds of pure paraffine per barrel of residuum, or from forty to sixty pounds per one hundred barrels of crude petroleum. Such paraffine, so produced, is at first of a dark olive-green color, and the oil pressed out is heavy, of offensive odor, and a characteristic blue or green color. Then a subsequent severe and expensive chemical treatment is required to decolorize both the paraffine and oil, and to somewhat deodorize the oil.

After being thus purified such oils are used as lubricants, but they are very deficient in body, and contain animal or vegetable oils, which compounds assume, to a great extent, the blue and green tint above referred to, which in commerce is objectionable, and paraffine oils thus made do not command a ready sale for the above reasons.

My improved mode for producing paraffine and lubricating oils is, as a process, directly the reverse of that above described. Instead of decomposing the paraffine, I so carry on the distillation as to prevent such decomposition as far as possible. In this process I distill with a comparatively low heat produced by free steam, superheated or not, at

688 pleasure, in a vacuum or partial vacuum, with or without a fire on the outside of the still, by which means I am enabled to produce paraffine in large quantity, and a superior quality of lubricating oil, both of which are of marketable quality and in fit condition for use, requiring but little further chemical treatment.

To enable others skilled in the art to make use of my invention, I will proceed to describe the same.

The crude petroleum or other hydrocarbon, having first been deprived of its lighter ingredients, such as gasoline, benzine, etc., by steam distillation or otherwise, is admitted into a vacuum-still of such construction as to permit the vapor of distillation to flow over freely, or to be drawn over, so that they shall not condense before leaving the still.

By a perforated pipe, or in other suitable manner, I admit steam (common or superheated) into the body of the still, keeping up at the same time, by suitable appliances, a partial or nearly complete vacuum. In connection with the steam-heat a moderate fire-heat may be applied to the outside of the still in any of the ways known to the art. The process of distillation is carried on till from thirty-eight to forty-eight per cent. of the crude material is driven off, which, being condensed, gives illuminating oil as a product, at which point the distillation shows a gravity of about 37° or 38° Beaumé. The contents of the still will then have a gravity of from 28° to 35° Beaumé, and contain a large per centage of paraffine. The distillate is then drawn off into another receiver.

The distillation is then continued with a comparatively low heat, so that the heavier ingredients of the oil shall not be decomposed, but, being vaporized, shall pass over freely or be drawn over into the condenser. The process is carried on as long as any yield of paraffine vapor can be obtained. It will be found that the condensed product becomes richer and richer in paraffine as the distillation goes on.

The condenser must be kept warm while this is going on, or the paraffine will solidify and clog the apparatus.

After the distillation is finished and paraffine ceases to come over, the residuum will be found to contain very little paraffine.

The distillation is then chilled and pressed. The oil being expressed, there remains paraffine of a good color, requiring very little further treatment previous to use. Commonly, remelting, rechilling, and
689 repressing will suffice to remove all deleter'ous or objectionable impurities, and produce a pure article of paraffine. In this way I obtain from eight to sixteen pounds of almost chemically pure paraffine per barrel of crude petroleum, the chief reason of this larger yield being that, in this process, the paraffine vapors are formed at a comparatively low temperature carried over freely and condensed without being decomposed in the still.

The oils which in the process described are expressed from the paraffiine product are, for lubricating purposes, vastly superior to the lubribricating oils produced by the distillation of the tarry residuum of the old process, or if made direct from petroleum by direct fire. Though of less gravity, averaging 30° to 35° Baumé, they have a much better body. They have but a slight pungent odor, which is easily and almost wholly removed by a slight subsequent chemical treatment, and have hardly a trace of the blue or green tint which is a distinctive characteristic and an objectionable feature of lubricating oils made by the ordinary process. The almost entire absence of the blue and yellow tint and offensive odor renders this oil, which I have introduced in commerce as neutral topaz oil, much more valuable than the lubricating oils produced by distilling

tar or petroleum or other hydrocarbon by the first process hereinbefore described and in general use.

The lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way.

By the qualities specified it is readily distinguishable by any one skilled in the art from all other lubricating oils heretofore known to the trade.

What I claim as my invention, and desire to secure by letters-patent, is—

1. The process of producing paraffine, hereinbefore described, by an exhaustive distillation of the heavy oil at a comparatively low temperature, by the use of steam in a vacuum-still with or without a fire heat, so as to drive over the paraffine vapors undecomposed, substantially as described.

2. The production, by the process hereinbefore described, of a lubricating oil as a new article of manufacture, possessing the distinctive and distinguishing features above set forth, viz, almost entire freedom from the blue and green tints which characterize the paraffine oils of commerce.

690 3. The use, in the distillation of oil, of a vacuum or partial vacuum in connection with steam, common or superheated, inside the still and an auxiliary fire outside, substantially as described.

In testimony whereof I, the said Herbert W. C. Tweddle, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

Witnesses:
W. BAKEWELL.
A. S. NICHOLS.

Complainant's exhibit No. 119.—*H. Farnum Smith, special examiner.*

Compliments of H. W. C. Tweddle. Works at Aladdin, Armstrong County, Penna.; office, 174 Wood st., Pittsburgh, Pa.

CIRCULAR.

Eclipse Lubricating Oil Works.

We beg to present this our second circular since the entire destruction of our works by fire, on the 28th of June, 1870.

Since then we have been steadily engaged in building up our new works, situated on the Allegheny Valley Railroad and the banks of the Allegheny River, thirty miles from the city, giving us eminent facilities for receiving and shipping our oils. We have nearly doubled the producing capacity of our former works, and have put up two more powerful vacuum-pans, holding 350 barrels each, which enable us to have always such a stock of our products on hand as to fill orders of any amount promptly.

Our works cover some twenty-five acres of ground, and comprise the borough of Aladdin. They have a capacity of over five thousand barrels railroad-axle oils per month, and are the most extensive in

691 the country, making railroad lubricating oils a specialty. The machinery and apparatus employed are entirely new, and are covered by patents granted to Dr. Tweddle.

We offer to the trade, and to purchasing-agents of railroads especially, our unsurpassed lubricating oils, which, according to many flattering

testimonials of leading railroads, have given always, in special consideration of climates and seasons, the best satisfaction.

We thus take pleasure in mentioning besides that all our oils are guaranteed pure; it being our interest to store large quantities of oil and giving the same ample time to deposit water and impurities.

Shipments will be made promptly, in through cars, from our works to any place in the United States connected by railroad, and the greatest care taken to use exclusively the best packages, which will bear our patent trade-mark. Circulars, price-lists, and samples sent on application. Quotations for eclipse R R. axle oils, subject to the fluctuations of the market.

We take pleasure in presenting a list of our products, manufactured under our patents by superheated steam in vacuo, embracing such as are adapted to every kind of railroad cars and machinery.

1. ECLIPSE WINTER RAILROAD-AXLE OIL.

Gravity 27° and 28° Beaumé; superior to the best West Virginia oils; combining viscidity, tenacity, and body, and is a perfect preventive of hot axles; stands a temperature of zero without thickening; does not chill and never gums. It is superior, inasmuch as the best heavy West Virginia oil gives off inflammable vapors at temperatures under 200° Fahr., whilst all our oils require 500° to 600°.

As we are exclusively manufacturers, we only sell pure oils, leaving it to our customers to compound our oils themselves, if necessary for certain purposes.

2. ECLIPSE SUMMER RAILROAD-AXLE OIL.

Gravity 26°, 27°, 28°, 29° Beaumé; adapted for hot season and tropical climates; does not run off in warm weather; is superior in body and viscidity to any West Virginia oil, and the most economical lubricant for railroad-cars and heavy machinery.

692 Our railroad-axle oil is manufactured in vacuo, and when applied to axles or journals does not lose volatile matter by evaporation, its burning test being 480° to 600° Fahrenheit thermometer. Many of our leading roads are using oils of 26° and 27° gravity in summer, on account of their superior body and eminent lubricating properties; even preferred to lard-oil in summer, on account of its unsurpassed body. No gum, no waste, no corroding slides! We challenge comparison!

3. ECLIPSE POLARINE VACUUM OIL, FOR LOCOMOTIVES, ENGINES, AND LIGHT MACHINERY.

A fine lubricant for sleeping-coaches, express-cars; does not congeal at zero; magnificent body; no gum, no offensive smell in factories, no inflammable vapors.

The large amount of railroad oils we are producing all the time enables us to offer to railroads our eclipse polarine oil as the best hydrocarbon lubricant, second to none in the market. As we use no chemicals, we guarantee it perfectly neutral; it does not corrode metals, does not gum, costs less, and is more economical than lard, whale, or tallow oils.

4. ECLIPSE NEUTRAL TOPAZ OIL FOR COMPOUNDERS.

In offering this well-known brand to compounders of machinery oils, we beg to draw their attention to the fact that it is the only hydrocarbon compounding oil in the market, which, according to its boiling-point of 650° Fahrenheit, does not evaporate any combustible gases or vapors at high temperature. The extreme cold at which the oil is manufactured, being 5° degrees below zero in winter, renders the same superior to any compounder known at present.

The "eclipse neutral topas oil" assumes, compounded with any kind of animal and some vegetable oils, the characteristic properties of the oil it has been combined with, making the combination uniform in every respect.

As this oil, as well as all our products, is manufactured in vacuo with superheated steam, we claim it the only hydrocarbon oil which is free from blue or greenish tinge caused by polarization of reflected light.

It is a well-known fact that animal and vegetable oils contain a
693 certain percentage of glutinous or mucilagenous matter. To prevent those lubricants from gumming, paraffine oils have been formerly used to cut the oils and to keep the gumming substances in solution. We admit that paraffine oils answer the purpose in some respect; but if the combinations are used in hot weather or in factories where high temperatures prevail, the low evaporating test of paraffine oils leads to many inconveniences, viz, offensive hydrocarbon smell, filling the atmosphere in workshops with combustible gases and vapors, and condensing oily matter on the window panes, frequently affecting the eyes of the operatives.

All these named disadvantages render paraffine oils unsuitable for a great many practical purposes, especially as compounded wool oils and spindle oils.

Our eclipse neutral topaz oil having no odor, no blue or greenish tinge, no hydrocarbon test, is appreciated by the trade as the most economical and useful compounder amidst all classes of compounding oils known heretofore.

Manufacturers of and dealers in lard, sperm, whale, tallow, neat's-foot and cotton-seed oils, as well as compounders of machinery oils, and animal or vegetable lubricants, will consult their interest by giving our eclipse neutral topaz oil the preference, thus affording better satisfaction to the consuming trade, and producing compound lubricators that are superior to animal or vegetable oils used in a pure state.

Used as a wool oil it does not stain goods, and will stand great heat or friction.

The eclipse neutral topaz oil for winter use does not congeal, thus reducing the chilling point of the animal or vegetable compounds to more than ten degrees Fahrenheit.

In comparison with the best brands of paraffine oils, the eclipse neutral topaz oil dissolves and keeps in solution permanently eleven per cent. of stearine, margarine, and glutinous matter in tallow oil, more than any other hydrocarbon oil.

Parties not yet familiar with the use of this oil are invited to give the same a fair trial.

Directions for use will accompany our invoices if requested.

Address: H. W. C. TWEDDLE,
Eclipse Lubricating Oil Works, Pittsburgh, Pa.

694 ADDITIONAL TESTIMONY FOR RESPONDENTS.

Deposition of Edward S. Thayer taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, May 28, 1872.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. Your firm, Seccomb, Kehew & Thayer, furnished to the Lightfoot Company, or their customers, a heavy paraffine oil for stuffing leather, and a light gravity paraffine oil for finishing leather, under the Lightfoot patents during the year 1868?

Ans. Yes, sir.

Int. 2. Who had the superintendence of the manufacture of such oils by your firm at that time?

Ans. I did.

Int. 3. Was any complaint ever made, to your knowledge, by the Lightfoot Company of the light gravity finishing oil so manufactured by your firm?

Ans. No, sir.

Int. 4. State, as nearly as you can, the quantity in barrels of the finishing oil supplied to them by your firm during the autumn months of 1868, and also the quantity in barrels of the stuffing oil.

Ans. I believe that in September, October, and November we sold about seventy barrels of the finishing oil, and about two hundred and fifty barrels of the stuffing oil.

Int. 5. Have the Lightfoot Company, or their representatives, continued since 1868 to order the stuffing oil from your firm?

Ans. Not since we had Dr. Tweddle's stuffing oil.

Int. 6. Have they continued since 1868 to order the finishing oil from your firm?

Ans. The Capitol Oil Company have up to this time.

Int. 7. Have you any knowledge or recollections of any of Seccomb, Kehew & Thayer's finishing oil being sent to Dr. Tweddle?

695 Ans. I have an indistinct recollection of sending him one barrel, but on looking over our books I cannot find that we ever sent him one.

Int. 8. In the deposition of Charles Toppan, a witness for the complainant in this case, he speaks of an order of Dr. Tweddle's for five barrels of your finishing oil to be sent to his Chicago agent. Did you ever know anything about such an order?

Ans. I did not.

Int. 9. If any order had been sent to Seccomb, Kehew & Thayer for finishing oil to be supplied to Dr. Tweddle, or any agent of his, or any arrangement made by your firm for supplying him or any agent of his with such oil, to whom would such order or arrangement have been communicated?

Ans. It would have been given to me.

Int. 10. Was there ever any such order given, or arrangement made, to your knowledge?

Ans. No, sir.

Int. 11. Have you here the letter-book of the Seccomb Oil Manufacturing Co., beginning in September, 1868, and ending in January, 1869?

Ans. I have.

Int. 12. Who were the Seccomb Oil Manufacturing Co. at that time; and is that name still continued by the parties?

Ans. It was then composed of very few stockholders, and is now. It has changed very little. Seccomb, Kehew & Thayer were then and

have been ever since the principal owners and agents of the company.

Int. 13. Where is the letter-book of that company just preceding the one which you have here?

Ans. Nearly all the books and papers and our correspondence with Dr. Tweddle were burned in a fire in 1868. They were not in a safe, but in a box in the second story, and were burned.

Int. 14. I find in the letter-book which you have here a letter of Seccomb, Kehew & Thayer to Dr. Tweddle, dated Oct. 23, 1868, in which this passage occurs: "Will you please send us five or ten barrels of your lightest colored and best winter par. lubricating oil at the lowest price you are willing to sell, (as sample.) If quality and price suit, we may be able to sell some of it." And I find another letter of your firm to Dr. Tweddle, dated Jan. 18, 1869, in which this passage occurs: "We telegraphed you this morning that your sample of deodorized oil
696 was received, and requested you to send immediately twenty barrels." What oil is this referred to in the passages just read?

Ans. The neutral topaz oil.

Int. 15. Did the second lot (20 barrels) come as ordered?

Ans. My impression is he sent a car-load at that time—that we ordered twenty, and that he sent forty or fifty. He sent more than we ordered, at any rate.

Int. 16. Had the paraffine been removed from both lots of this neutral topaz oil?

Ans. It had.

Int. 17. Before the order of Oct. 23, 1868, for the ten barrels, had you seen a sample, here in Boston, of such oil? And, if so, state the circumstances of your seeing it, as well as you remember them.

Ans. We never ordered any oil without seeing the sample. As I recollect it, Dr. Tweddle brought a sample to Boston with him, and we sent to the hotel for it. This was a sample bottle of the oil. I can't tell just when it was. At any rate, it was before we ordered the oil.

Int. 18. Describe the characteristics of that sample as you remember them; and state also what occurred in your firm, if anything, in consequence of the exhibition of that sample.

Ans. The oil was the same as the neutral topaz oil of to-day. Mr. Kehew showed me the sample and told me I was nowhere in manufacturing oil, and I took offence at it and told him if he could do any better than I, to go down to Salem and manufacture the oil himself.

Cross-examination by Chauncey Smith, esq., of counsel for complainant:

Cross-int. 19. In your answer to 1st interrogatory you say you furnished heavy paraffine oil for stuffing and light gravity oil for finishing leather, to the Lightfoot Company; what were the gravities of those respective oils?

Ans. There is no difference in the gravity Beaumé; one had the paraffine wax in and the other out. The specific gravities of both were the same.

Cross-int. 20. What price did you pay Dr. Tweddle for the five barrels of sample oil referred to in your letter of Jan'y 18, 1869, and also for that you received subsequently on your order for twenty barrels?

697 Ans. I don't recollect. My impression is about the price of paraffine oil.

Cross-int. 21. Can you ascertain by referring to your books?

Ans. If the books are in existence, I can.

Cross-int. 22. When you say "about the price of paraffine-oil," what oil do you refer to, and what was the price of such oil at that time?

Ans. I meant our own oil. I don't recollect the price at that time; say, from thirty to forty cents.

Cross-int. 23. Do you think the books are in existence which will show the price of the oil you so had from Dr. Tweddle?

Ans. I think they are.

Cross-int. 24. Will you make an examination and see what the price was, and give us the result this afternoon or to-morrow?

Ans. I will.

Cross-int. 25. What did you do with that oil?

Ans. As I remember, we mixed it with our paraffine oil and sold it for lubricating.

Cross-int. 26. Will your books show what you did with it?

Ans. I think they will.

Cross int. 27. Will you examine with reference to that also, and see in what proportions it was mixed with your oil, and with which kind of oil, and to whom you sold the oil and at what price?

Ans. I had it all in writing, but the book which contained it was burned in our fire last October, so that now I can tell nothing about it. Since answering the twenty-sixth cross-interrogatory, I remember that the books containing all the particulars of mixing, etc., were burned. I can doubtless tell the price at which we took the Tweddle oil to our account by reference to other books.

Cross-int. 28. Have you purchased any more of that kind of oil from Dr. Tweddle since the purchase you have before referred to?

Ans. We have used more or less of it ever since, but I don't think we have bought any since January last.

Cross-int. 29. Will you see also at what prices you purchased such oils since the first lot referred to?

Ans. I will; but I think I can answer now—from forty-five to fifty cents.

698 Cross-int. 30. For what purposes have you used the oil you have purchased since the first lot?

Ans. As I recollect it, Mr. Kehew mixes about five gallons of it with a barrel of our paraffine oil for spindle oil.

Cross-int. 31. What is the gravity of your oil with which you mix this oil?

Ans. I should say it averaged twenty-seven and a half.

Cross-int. 32. Will you ascertain from your books when you received the oil which Dr. Tweddle sent you under the order of January 18th for twenty barrels?

Ans. I will.

Adjourned to 29th inst., at 11 a. m.

Adjourned to 31st, at 1.30 p. m.

31ST MAY, 1872.

Resumed:

Deponent saith as follows in answer to the 20th cross-interrogatory: I would say I find that we paid for the first lot twenty-five cents a gallon, fixing our own price, and for the second lot forty cents per gallon.

As to the matter inquired of in the 29th cross-interrogatory, I find as follows:

1870.

Jan.	27,	20 barrels,	@	.....	63 cts.
May	25,	11 "	@	.....	52
Dec.	8,	5 "	@	.....	55
"	31,	9 "	@	.....	50

1871.

March 13,	20	"	@	50
" 14,	20	"	@	48
" 20,	10	"	@	49
" "	4	"	@	48

Since which we have purchased several lots, and the price has been forty-six cents.

As to the 32d cross-interrogatory, I find the freight-bill was paid for that lot on the 13th of February, 1869.

E. S. THAYER.

699 *Deposition of James Cuddy, taken, subscribed, and sworn to before B. C. Christy, esq., notary public, June 1st, 1872.*

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. What is your name, age, residence, and occupation?

Ans. My name is James Cuddy; age, 54; reside at 30 Seventh street, Pittsburgh; and present occupation a broker in oil-refiners' supplies, paints, and chemicals.

Int. 2. Have you had any experience in the manufacture of refined or illuminating oil from petroleum; if so, will you state when and for how long you were engaged in such business, and in what places and establishments?

Ans. I was engaged from the commencement of the business in 1860 until 1869 in the Lucesco Oil Works, Westmoreland County, Pennsylvania; North American Oil Works, Armstrong County, Pennsylvania; and Standard Oil Works, Pittsburgh, Pennsylvania, as manager in all those establishments.

Int. 3. Did you superintend the construction and equipment of any of the works you have mentioned; if so, which one?

Ans. I superintended the erection and construction of *of* the Lucesco Oil Works, for coal-oil manufacture, in 1858; of the refining department of the North American for petroleum, and of some extensions of the Standard Works, Pittsburgh.

Int. 4. What was the rank of the Lucesco Works among the refineries in this part of the country in point of capacity, and what that of the North American?

Ans. The Lucesco Works were the largest coal-oil works west of the mountains, and when adapted to petroleum had a capacity for refining five thousand barrels per month. The North American had a capacity for refining three thousand barrels per month.

Int. 5. When were the Lucesco Works adapted for petroleums?

Ans. About the close of the year 1860 or beginning of 1861, as near as I can recollect.

700 Int. 6. Was paraffine oil produced in any of these establishments, or did they manufacture exclusively illuminating oil?

Ans. They manufactured only illuminating oil from petroleum.

Int. 7. During the time you were in this business, from 1860 to 1869, did you know of any concerns in this part of the country that manufactured paraffine oil as well as illuminating oil?

Ans. I should like to know whether by the term paraffine oil is mean lubricating oil?

Int. 8. Yes.

Ans. There were no establishments at that time in the manufacture

of lubricating oil—I mean at the outset, in 1860 and 1861. Lubricating oil had been produced from coal oil before that time in this vicinity.

Int. 9. Did the works at Corry make paraffine lubricating oil? if so, when did you first know of that?

Ans. I think it was in 1864 that I first heard of that, as near as I can recollect.

Int. 10. With that exception did you know of any concern that manufactured paraffine lubricating oil from petroleum in this part of the country until Dr. Tweddle began to make it?

Ans. Pennock, Ball & Co. made lubricating oil about that time in this city, and I heard that some other small establishments also made it.

Int. 11. During the years in question, from 1860 down to 1868, was the attention of manufacturers of petroleum in this part of the country directed chiefly to illuminating oil?

Ans. It was; all the largest works made illuminating oil only.

Int. 12. In your experience in the manufacture of illuminating oil from petroleum, have you been familiar with the process of decomposing, or, as it is sometimes called, cracking the heavier oil vapors for the purpose of obtaining the maximum of illuminating oil?

Ans. I have.

Int. 13. Within the time covered by your experience or knowledge, has any change in the construction or setting of stills been introduced to facilitate this cracking?

Ans. Many changes.

Int. 14. I refer particularly to the exposure of the upper part of the still to the cooling effect of the outer atmosphere; will you answer as to that?

701 Ans. Many manufacturers at first had the top of their stills covered with brick work, believing that it would hasten the operation of distilling, but had to remove the covering and leave the upper part exposed, because the oil had become heavy and discolored, while the tops were covered.

Int. 15. Will you explain the connection between this discoloration of the oil (meaning, I suppose, illuminating oil) and the imperfection of the cracking process?

Ans. The object of uncovering the upper portions of the stills was to condense on their surface the heavier portions of the gases, and to allow the lighter portions that were without color to pass over through the worm.

Int. 16. If I understand you, then, when you say that the oil became heavy and discolored, while the tops were covered, you mean that the heavy oil vapors were not decomposed or "cracked" as was desired. Do you so mean?

Ans. That is my meaning.

Int. 17. About how many barrels of petroleum did you work, during the best of the year that you were in the business?

Ans. About a hundred thousand barrels.

Int. 18. How many gallons to the barrel?

Ans. Forty gallons to the barrel.

Int. 19. What percentage of refined oil did you get?

Ans. I have gotten as high as seventy-seven per cent. on six months' work, and as low as seventy, according to the gravity of crude oils received.

Int. 20. Within what limits did the gravity of the crude oils vary?

Ans. From forty-two degrees of Beaumé to forty-seven, and occasionally to forty-eight.

. Int. 21. Which gave the greater yield of illuminating oil, the heavier or the lighter gravity of crude, and why?

Ans. The lower gravities gave the largest yield because there was less benzole produced in distillation.

Int. 22. What was the capacity of the largest still which you used while engaged in making illuminating oil?

Ans. One thousand barrels.

Int. 23. What was the height from the top of the stand-pipe where the goose-neck started out from it down to the level t' which the oil
702 was when "cracking" began, as the stills were constructed in the refineries that you managed?

Ans. From seven feet to fifteen feet.

Int. 24. Will you describe the deposit of coke which takes place in the bottom of a still and in any other part of a still and its connections, when the "cracking" operation of which we have been speaking is performed?

Ans. There is a deposit of hard coke always on the bottom of the stills at the close of each operation and a deposit of a light porous substance in the stand-pipe and occasionally in the condensing pipes.

Int. 25. Does this coke have to be removed from the bottom of the still after every run; and, if so, why?

Ans. It has to be removed and the still thoroughly cleaned out at the end of each operation to prevent the metal from being burnt and the distillate from being discolored.

Adjourned to meet June 3, 1872, at 9 a. m.

JUNE 3, 1872.

Met pursuant to adjournment; present as before.

Int. 26. With what sort of instruments is the coke removed from the bottom of the still, and how is it done?

Ans. By picks and scrapers; steel-edged tools.

Int. 27. Describe these picks a little more clearly as to size and how they are used.

Ans. They are about the size of collier's picks, say from fifteen to twenty inches long. Some of them have an edge from one to two inches, for clearing off the *the* surface of the plates, and others are reduced to points to clean off the coke from round the head of the rivets. The scrapers generally used are from three to six inches broad, for gathering together the softer portions of the coke.

Int. 28. Do the blows of the picks for chipping away the coke from the bottom of the still leave marks upon the iron of the still; if so what kind of marks? How would you tell from the examination of the bottom of the still whether coke had been deposited there and cut out?

Ans. The blows of the tools do leave marks on the bottom of the stills from the harder metal striking the softer. And I could tell that
703 tools had been used in cleaning out the still from the indentations left on the metal of the bottom.

Int. 29. Have you recently examined a cast-iron still, or the dismounted parts of it, upon the site of the old Eclipse Works at Sharpsburg bridge, formerly owned and conducted by Dr. Tweddle?

Ans. I have.

Int. 30. Did you at Dr. Tweddle's request examine that still to see if there were any indications about it that the cracking process had been practised in it?

Ans. I did examine it at his request on the 13th and 14th of last

month, and found no indications of the cracking process having been used in it.

Int. 31. Did you find particularly any such marks upon the bottom of the still as would have been made by the picks as you have described, had coke been deposited there and cut out?

Ans. I found no such marks.

Int. 32. If that still had been charged at any time with the crude petroleum of forty-three degrees gravity, and seventy-four perc ent. of illuminating oil obtained by distillation therefrom by the aid of cracking, would there or not have been a large deposit of coke in the bottom of the still?

Ans. There would.

Int. 33. From your inspection of that still, or the parts of it, what is your opinion upon the question whether the cracking process had been practised therein?

Ans. It is my opinion that the cracking process had not been practised in it.

Int. 34. Did you find among the parts of this still two boxes or sets of pipes for superheated steam which were intended to be placed in the interior of the still?

Ans. I did.

Int. 35. Assuming these pipes to be in position in the still, would it in your judgment have been practicable to have cut out the coke which would have been formed in the bottom of the still by the practising of the cracking process therein?

Ans. It would not.

Int. 36. Is it practicable to practise the cracking process so
704 that tar shall be deposited in the bottom of the still without coke also being deposited there?

Ans. It is not.

Int. 37. Explain why not.

Ans. Because as each layer of tar is deposited on the metal the heat from the fire keeps converting a portion of it into coke, and that process continues until the end of the operation.

Int. 38. Will you state what, if anything, you observed about this cast-iron still at the Eclipse Works indicating the amount of heat to which it had been subjected at the time of the fire in which the works were destroyed?

Ans. I was present at the fire on the evening on which it occurred. The whole site of the works was for nearly two hours a sheet of flame. I found when I went to examine the still last month, that the lead had been melted from out the joints of the different sections of the still, and that all the exposed portions of the still, or still connections, bore traces of the effects of the fire.

Cross-examination by Chauncey Smith, esq., of counsel for plaintiff.

Cross-int. 39. How long were you superintendent of the Lucesco Works, and also of the North American and Standard Works?

Ans. Of the Lucesco Works from November, 1858, until January, 1860. Of the North American Works from January, 1860, until January, 1867. Of the Lucesco Works again from October, 1866, until February, 1867, and of the Standard Works from January, 1867, until January, 1869.

Cross-int. 40. Did they commence refining petroleum at the Lucesco Works before you left there at the time of your first employment?

Ans. No, sir; the petroleum refining trade had not then been opened in this neighborhood.

Cross-int. 41. When did you commence refining petroleum at the North American Works?

Ans. In 1861.

Cross-int. 42. Did these three companies while you were with them sell their refined petroleum in whole or in part in the eastern markets?

Ans. Nearly all the products were sold in the eastern markets.

Cross-int. 43. Do you know whether any other refineries in this vicinity or in the vicinity of the oil regions sold their products in the eastern markets?

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Ans. The greater portion of all the refined burning oil was sold in the eastern markets.

Cross-int. 44. In the early days of the refining of petroleum were you acquainted with the manner in which petroleum was distilled in other refineries besides the North American, with which you were connected?

Ans. I was.

Cross-int. 45. In any of the refineries with which you were acquainted, including your own, did they ever in the early days of refining petroleum, when petroleum was very cheap, run off the white or refined oil until the distillate began to show a degree of color, and then draw off the residuum of the still without attempting to crack it up into lighter oils?

Ans. I never did that myself, and I never knew of any refiners in this neighborhood who did so.

Cross-int. 46. What was the size of the stills used at the North American at the time you left it?

Ans. They were the old pattern of coal-oil stills, forty barrels capacity each.

Cross-int. 47. Will you give their dimensions?

Ans. They were about nine feet long, four and a half feet wide, and six feet deep.

Cross-int. 48. What was the shape of the bottom?

Ans. The bottom was flat.

Cross-int. 49. What was the shape of the top?

Ans. The top was flat also.

Cross-int. 50. How was the heat applied to the stills?

Ans. Directly under the bottom.

Cross-int. 51. Were they wrought-iron stills?

Ans. They were.

Cross-int. 52. How were they set?

Ans. They were set on a fire-brick furnace at first about two and a half feet from their grate-bars, and afterwards about four feet from their grate-bars.

Cross-int. 53. Was there any casing around the sides or top of the still?

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Ans. There was a fire-brick casing to within about eighteen inches of the top. The top was uncovered.

Cross-int. 54. Where were the vapors drawn off?

Ans. I hardly understand that question. I ask, does it mean where the incondensible vapor escapes or where the distillate is drawn off?

Cross-int. 55. Where did the condensible vapors which arose from the oil pass out of the still in order to reach the condenser where they were condensed?

Ans. Out through the top and stand-pipe to the worm.

Cross-int. 56. What were the dimensions of the stand-pipe?

Ans. About five feet high, twelve inches diameter, and the outlet pipe about five inches diameter, as nearly as I can recollect.

Cross-int. 57. How nearly full did forty barrels fill the still?

Ans. The stills were filled within ten inches of the top.

Cross-int. 58. When the oil in the still had reached such a density that it was necessary to commence cracking it, did you make any change in the management of the fires?

Ans. I did.

Cross-int. 59. What was the change?

Ans. I then fired more slowly, and regulated the firing by the color of the oil that ran from the worm.

Cross-int. 60. You ascertained when it was necessary to commence the cracking by the color of the oil that ran from the still, did you not?

Ans. Yes; the color was what guided the operation.

Cross-int. 61. About how large a proportion of the oil would generally be run off before the color of the oil would indicate that the point for the cracking to commence had been reached?

Ans. Generally about two-thirds.

Cross-int. 62. And how much of that would generally have been naphtha or benzole or non condensible gases?

Ans. From five to twenty-five per cent., according to the gravity of of crude petroleum used.

Cross-int. 63. And when you were using a crude petroleum of heavy gravity, did you not reach the point at which cracking was to commence sooner than when you used a petroleum of light gravity?

Ans. I did.

707 Cross-int. 64. Take the heaviest that you mentioned, a gravity of forty-two, how much would you generally run off before reaching the point for cracking?

Ans. About sixty per cent.

Cross int. 65. About what depth of coke would you have on the bottom of the still at the conclusion of the process?

Ans. One or two inches.

Cross-int. 66. About what percentage would this be by weight of the crude petroleum?

Ans. Perhaps five per cent.

Cross-int. 67. Were you acquainted with any refiners who were in the habit of stopping distillation at an earlier point, where the residuum in the still would run off as a tarry body?

(Objected to.)

Ans. It was usual to get a few barrels of liquid tar at the close of operations.

Cross-int. 68. The amount of that liquid tar depended, I suppose, upon the extent to which the distillation was pushed?

Ans. It did.

Cross-int. 69. It could be pushed so far as to bring the residuum to dryness, as it was called, could it not?

Ans. It could.

Cross-int. 70. Did you ever know any refiners practise their operation so as to draw off the residuum before any part of the residuum had become solid?

Ans. I did not.

Cross int. 71. In the stills which you have used or seen used, in which it was necessary to remove a hard deposit of coke by the aid of picks and other instruments, were not the fires applied directly to the bottom of the still?

Ans. They were.

Cross-int. 72. These bottoms were wrought-iron, were they not?

Ans. Both wrought-iron and cast-iron, chiefly wrought-iron.

Cross-int. 73. What were the dimensions and shape of the stills used at the Standard Works when you were superintendent, and at the Lucesco Works the last time you were employed there?

708 Ans. The shapes of the stills used at the Standard Works were cylinders laid horizontally and one large still shaped like a marine steam-boiler, and at the Lucesco Works they were all flat-bottomed stills. The capacities of those at the Standard were three hundred barrels, five hundred barrels, seven hundred barrels, and nine hundred barrels; those at the Lucesco, from forty barrels to five hundred barrels.

Cross-int. 74. Will you give the diameter and height of the horizontal stills, and the dimensions of the stand-pipe of each?

Ans. I don't recollect the dimensions now of the stills, the length and diameter. The stand-pipes were from five to twelve feet high; the tallest stand-pipes were on the smallest stills; I can't precisely give their diameters; they were from twelve to twenty inches.

Cross int. 75. You spoke in your direct examination of one 1000 barrel still; that you had used; where was that still, and what were its dimensions?

Ans. That was the large still referred to at the Standard Works. Its dimensions were equivalent to a thousand barrels. It was charged with nine hundred barrels.

Cross-int. 76. Can you give its height and its horizontal dimensions, and the dimensions of the stand-pipe?

Ans. I don't recollect the dimensions of the still exactly. The height of the stand-pipes (there were two of them) was about five feet; diameters, three or four feet.

Cross-int. 77. What was the shape, horizontally, of that large still?

Ans. It was nearly square, rounding at the corners, with a bottom curved upwards forming an arch in the bottom; the top curving upwards like a trunk cover. It was nearly the curvature of the letter D.

Cross-int. 78. I would like to have you give me as near as you can the height of this still and its horizontal dimensions.

Ans. As nearly as I can recollect, it was about twelve feet deep; I think about twenty feet long. The width I can scarcely give a guess at. I have not seen the still for years.

JAMES CUDDY.

709 *Deposition of Joseph Musgrave, taken, subscribed, and sworn to, before B. C. Christy, esq., notary public, June 1st, 1871.*

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. What is your name, age, residence, and occupation?

Ans. Joseph Musgrave; thirty-nine years old; Larimer City, Wyoming Territory; travelling auditor of the Union Pacific Railroad.

Int. 2. Do you know Dr. Tweddle, of Pittsburgh; and how long have you known him?

Ans. I do; have known him for about nine years.

Int. 3. Where were you in the year 1867?

Ans. In West Virginia, and in Pittsburgh, Pennsylvania.

Int. 4. Did you go West in 1868?

Ans. I did.

Int. 5. What time, as nearly as you can state?

Ans. In the latter part of the month of October, 1868.

Int. 6. Since that time where have you been?

Ans. I have been West all of the time, with occasional visits East.

Int. 7. Before going West in October, 1868, did you have anything to do with the distribution of certain circulars put out by Dr. Tweddle, relating to the supply of oils for tanners' and curriers' use; if so, will you state what you did?

(Objected to as not being competent in rebuttal of evidence offered by the complainant.)

Ans. I obtained the names of all the tanners and curriers I could find in the neighboring States, including this State also, and directed envelopes containing circulars of Dr. Tweddle's, and sent them to the parties through the post-office.

Int. 8. Will you look at the circulars printed on pages 376 and 377 of the record of this case, and say whether those were the circulars which you so sent out?

(Objected to as above.)

Ans. I have, and those are copies of the circulars I sent out.

Int. 9. At the time of requesting you to attend to this matter
710 for him, and previously to such request, had Dr. Tweddle spoken to you of his intention to supply oil for tanners' and curriers' use?

(Objected to as above.)

Ans. He had.

Int. 10. More than once?

(Objected to as above.)

Ans. Many times. It was the subject of repeated conversations.

Int. 11. What oils did he say, in these conversations, he proposed to furnish for tanners' and curriers' use?

(Objected to same as above, and also being merely hearsay testimony.

Ans. I would ask if that is in reference to the colors of the oils?

Int. 12. Yes; it refers to the different colors and the different weights and descriptions of the oils.

(Objected to as above.)

Ans. The color of the oils shown to me was a kind of olive-oil color. The gravity and marks I do not recollect. There was several samples shown me; there was a little variation in the color.

Int. 13. Was there any heavy dark oil also shown to you?

(Objected to as above.)

Ans. There was a greenish black, heavy oil.

Int. 14. In reference to these oils which you say the doctor, in the conversations, proposed to furnish for tanners' and curriers' use, whose manufacture were they?

(Objected to as above.)

Ans. They were manufactured at the Eclipse Refinery by Dr. Tweddle.

Int. 15. Did the doctor ever say anything to you about proposing to sell tanners' or curriers' oil of any other parties' manufacture?

(Objected to as above.)

Ans. He never made the slightest allusion to it.

Int. 16. What occasion had you to know anything about, or give any attention to, the doctor's manufacturing business at this time or previously?

(Objected to as above.)

Ans. It was understood between us that I should take an active in-
711 terest in the business when organized, which was the cause of my being so much at the doctor's works and noticing the different kinds of oils that he manufactured.

Int. 17. When did you first see such oils as were described of the doctor's manufacture?

(Objected to as above.)

Ans. In the first part of October, 1867.

Int. 18. Did you notice the odor of the olive-oil-colored oil, of which you have spoken? If so, will you state whether it was a sharp, offensive odor, or otherwise?

(Objected to as above, and also because the question is leading.)

Ans. The oil was not unpleasant, it was nearly *odorous*, [odorless.]

Int. 19. Did you notice the presence or absence of a blue and green tinge when seen by reflected light?

(Objected to as last above.)

Ans. My impression is that no blue tinge was there, as near as I can recollect. That is the impression I have.

Int. 20. Did you see any oils in process of making at Dr. Tweddle's refinery either in 1867 or 1868?

(Objected to as above.)

Ans. I did both in 1867 or 1868.

Int. 21. How early in 1867?

(Objected to as above.)

Ans. They were the same kind of oils I saw in 1868; I saw them in October, 1867.

Int. 22. When you saw these oils making there in October, 1867, what kind of a still was in use for the purpose; wrought-iron or cast-iron?

(Objected to as above.)

Ans. My knowledge of machinery was very imperfect, but it was a cast-iron still.

Cross-examination by Chauncey Smith, esq., of counsel for plaintiff. De bene.

Cross-int. 23. What was your employment in 1867 and in 1868, before you went West?

Ans. In West Virginia, in 1867, I was selling goods, assorted
712 stocks, and from October, 1867, to October, 1868, I was in no business, except with Dr. Tweddle.

Cross-int. 24. Prior to October, 1867, had you had any experience in the manufacture, sale, or use of petroleum oils?

Ans. I had for three years previous.

Cross-int. 25. What had it been?

Ans. Connected with the sale of oil.

Cross-int. 26. What kind of oil, and to what extent?

Ans. Illuminating oil. I was at that time with Clark & Sumner, and acted for them in many cases.

Cross-int. 27. Who were Clark & Sumner?

Ans. They were at that time owners of the Standard Refining Works at Pittsburgh.

JOSEPH MUSGRAVE.

H. W. C. TWEDDLE, recalled:

Int. 1. It is stated by Herman Keller, a witness for the plaintiff, that you couldn't use the cast-iron still at all (meaning the cast-iron still at the Eclipse Works in 1867,) couldn't make any oil in that, couldn't get enough heat in it; if you know of any difficulty which arose at any time in the working of this still, (excepting the leaking of steam through the superheated pipes to which you have heretofore referred,) will you state what it was, and when it occurred.

(Objected to as not being open for testimony at the present stage of the case in rebuttal of any testimony heretofore offered by the plaintiff.)

Ans. Soon after the still was finished I had a good deal of difficulty with my vacuum-engine pumps. We were unable to keep up and maintain a vacuum in the still. An alteration of the pumps was rendered necessary. This difficulty lasted more or less for eight or twelve days, when we had the alteration effected.

Int. 2. It is also testified by the same witness, that in using the two wrought-iron stills the cast-iron still was used for first heating up the oil. Is this correct; if not, how was the oil heated up?

(Objected to as above.)

713 Ans. It is not correct. There was a tank or still holding between five and six hundred barrels in the yard, built expressly for heating up the crude oil, and distilling off the benzole under atmospheric pressure, prior to its introduction into the stills. Instead of one there were two such tanks for that purpose, which were charged alternately.

Int. 3. It is testified by the same witness, in answer to the ninth cross-interrogatory, namely, "Do you know what was done with the oil distilled from that iron still? Where was it put?" "He couldn't use it, what I know, so long as I was there. He used some for the other purposes." Did you use the cast-iron still for any other purpose than to distil oil from it?

(Objected to as above.)

Ans. I never used the cast-iron still for any other purpose than to distil oil from.

Int. 4. It is testified by the same witness that benzine-pipes were laid to the stills which were set up at Aladdin for Mr. Brereton. Who designed those stills?

(Objected to as above.)

Ans. I designed them in the summer and fall of 1867.

Int. 5. Did you provide or give any directions for the use of a benzine-pipe with them?

(Objected to as above.)

Ans. No.

Int. 6. It is testified by Byron M. Peck, a witness for the plaintiff, that in February, 1869, you called at the office of his firm, J. H. Pease & Co., of Pittsburgh, for the purpose of purchasing five hundred barrels of the Cleveland paraffine-oil, for which they were selling agents. Is that correct?

(Objected to as above.)

Ans. It is not. I may have spoken to him to try and draw him out and see what he was doing, but had no idea of purchasing from him.

Int. 7. What occasion had you to try and draw him out and see what he was doing?

(Objected to as above.)

Ans. He or the firm to which he belonged tried to purchase oils from me on time. He said they were the agents of a Cleveland house,

714 I think Moorhouse, Freeman & Co. I thought it strange that if he was their agent that he should try to purchase lubricating-oils from me. I went to make inquiries regarding them in a neighboring office to theirs. The result of my inquiries were unsatisfactory. As I was leaving this office I saw Mr. Peck or his partner at the door of their office, and we did talk something about Moorhouse's oil. The result was, as I had been led to believe, their agency for Moorhouse had either

closed or was about closing, and I found out that they were not in a position to do any business with me on a satisfactory financial basis. I refused to sell them oils except for cash, and I think they were irritated by the termination.

Int. 8. On what terms were you selling oils to other parties at this time?

(Objected to as above.)

Ans. Sixty and ninety days, sometimes four months.

Int. 9. It is testified by the same witness, Peck, that he had another interview with you in February, 1870, at the office of Lockhart, Frew & Co., in which interview you told him that you had recently made improvements in your works and productions, and showed him a sample called "neutral topaz;" that the improvements that you had made in your oil were in odor and color more particularly; that they were neutral as the name indicated, being really water white: also, in connection with the neutral topaz oil, that you referred to the bluish or greenish tinge, and said that you had succeeded in removing that almost entirely or quite; that the neutral oil could be mixed with animal oil without showing that tinge, a feat that had never been previously accomplished by any one; and that you said that you had, since his interview with you in February, 1869, improved on that point as well as in color and odors. How far is this statement of what took place at the interview in question correct, and how far incorrect?

(Objected to as above?

Ans. At the interview with Mr. Peck I did not tell him that I had made improvements in my productions either in odor or color. It is incorrect that I told him that I had made the neutral topaz oil water white or nearly so. As to the bluish or greenish tinge, I had effected that on a practical scale early in 1867. My interview with him was so short that I neither had the opportunity or the desire to converse
715 with him at length upon the subject. I do not think any conversation we had lasted more than one or two minutes.

Int. 10. If you had in fact made any improvements either in your oil or in your mode of making it since your former interview with Peck, in February, 1869, will you state what those improvements were, or to what they related?

(Objected to as above.)

Ans. We made some improvements with regard to freezing and pressing our neutral topaz oil, so as to more perfectly separate paraffine and make the expressed oil stand a lower temperature without chilling.

Int. 11. I believe you are practically acquainted with the cracking process, so called, practised for the purpose of getting the maximum of illuminating oil from a charge of petroleum or petroleum tar?

(Objected to as above.)

Ans. I am.

Int. 12. I would ask you first to what products the attention of large petroleum manufacturers in this part of the country was directed from the time of the introduction of petroleum down to 1868, and why?

(Objected to as above.)

Ans. It was almost exclusively directed to the production of illuminating oils, for the reason that the business was very profitable up to about that time, and the attention of refiners here had not been directed to the manufacture of lubricating oil, for there was not any demand or great demand for those products; and at the present time were I to push my works and apparatus which I have to its full capacity, I could

flood the American markets with petroleum lubricating oils at any time by two months' steady work.

Int. 13. Is the deposition of coke in the bottom of the still a necessary incident of the cracking process?

(Objected to as above.)

Ans. It is.

Int. 14. Will you state what the practice is for removing or dislodging this coke from the bottom of the still in refineries where cracking is practised?

(Objected to as above.)

Ans. The practice is for the men to take out all the loose coke as clean as possible, and then dislodge with picks and chisels the hard coke
716 scale which adheres to the iron at the bottom of the still. Great care is exercised in all our refineries to do this thoroughly.

Int. 15. Do the tools used for this purpose leave upon the still any marks of their use; if so, what?

(Objected to as above.)

Ans. They leave indentations on the iron, to a greater or less extent.

Int. 16. Can tar be deposited in the bottom of a still by the use of the cracking process without the deposition of coke?

(Objected to as above.)

Ans. The cracking process, if carried to any extent, must deposit carbonaceous matter.

Int. 17. If in the cast iron still used by you in 1867 at the Eclipse Works when you obtained seventy-four per cent. of illuminating oil from crude petroleum of forty-three degrees gravity the cracking process had been practised, would there or not have been a deposition of coke in the bottom of that still?

(Objected to as before.)

Ans. If the cracking process had been used, there would have been a deposit of coke.

Int. 17. Is there anything in the appearance or condition of the cast-iron still indicating whether or not cracking was ever practised in that still; if so, will you describe what the condition of the still is in that respect?

(Objected to as above.)

Ans. The only indication in that still of cracking ever having taken place is the results of the effect of the fire which destroyed my refinery in June, 1870. On the day that the fire took place, there was in the still some forty barrels of heavy oil about twenty-six gravity. On that day there was no exit to the condenser from the still, owing to the fact that the condenser belonging to it had been used for the purpose of condensing a distillate from a new vacuum-still which I had just put in operation. When the fire took place, the brick walls of the building were partly thrown down on the still. The bottom connections of the still were either broken off by the walls or the roof falling in. This oil in the still escaped into a cavity in below the still, leaving, I think, a small portion in. A severe fire surrounded this still for forty-eight
717 hours, more or less. The heat of the fire melted out all the lead joints in the still. I presume that a portion of the oil remained in the still and was vaporized and decomposed by the hot stand-pipe; for at the top of the hemisphere on which the stand-pipe stands I observed a deposit like asphalt hanging down in threads six or eight inches long; part of it had run down the sides of the still in little streams, and formed small irregular deposits of cokey matter. In all my experience

in distilling petroleum oils by the cracking process, I have never observed such a deposit of asphalt. In the ordinary cracking process the only deposit ever formed on the sides, top, or stand-pipes of stills is a sooty carbonaceous matter readily brushed off. Never in any case have I known asphalt or coke deposited at an elevated portion of the still. It would have been impossible to have cracked oil in that still, for the joints in the man-hole at the bottom were of lead. In fact, all the joints on the still were made with lead, and the temperatures used in the cracking process melt lead. When using the still with a vacuum, every square inch of its surface is subjected to a pressure of fourteen or fifteen pounds per square inch externally of the atmosphere, which, of course, had the lead been melted, or even softened, the lead would have been forced by the atmospheric pressure into the still, and destroyed the vacuum by admitting external air, and were a distillation in progress at such an elevated temperature an explosion would ensue in all probability.

Int. 19. Was any cracking or decomposition of oil-vapors ever practised in that still?

(Objected to as above.)

Ans. Never.

Int. 20. Was any coke ever deposited in that still?

(Objected to as above.)

Ans. Never.

Int. 21. Had there been any coke deposited in that still on the bottom, would it have been practicable to cut it away, supposing the two sets of superheated steam-pipes to have been in the position in which they were in the use of the still?

(Objected to as above.)

Ans. It would have been impossible or almost impossible to have cleaned it out.

718 Int. 22. Are there any marks on the bottom of the inside of that still such as would have been made if coke had been cut away therefrom in the manner you have described as incidental to the cracking process?

(Objected to as above.)

Ans. There are not.

Int. 23. Why is it that in distillation with a vacuum there is no cracking and no deposition of coke?

(Objected as above.)

Ans. Owing to the low temperature and rapidity with which distillation is effected, no decomposition takes place. The oil vapors do not remain in the still and be subjected to redistillation, as in the ordinary cracking process, but pass as rapidly as they are formed into the condenser. The oil vapors are also assisted in being removed by the currents of superheated steam thrown into the vacuum-still. The rapidity of their removal may be conceived from this fact: that on one occasion I had a tank of some four or five hundred barrels of illuminating-oil which was accidentally discolored by some crude petroleum being let into the tank. I redistilled it all through that vacuum-still in about a day and a half and made it a good color again. Atmospheric air flows into a vacuum at the rate of about sixteen or eighteen hundred feet per second, which will give some idea how rapidly vapors formed in a vacuum-still rush over to the condensers. It would have taken a still of the same size under atmospheric pressure heated by fire at least four or five days to have effected the distillation which I effected in the vacuum-

still in a day and a half. By a day I mean in each case twenty-four hours.

Int. 24. What provision is needful to be made and is made in vacuum stills, in regard to the extent of condensing surface, with reference to the speed with which the oil-vapors pass away from the point of distillation?

(Objected to as above.)

Ans. In my practice in the cast-iron still put up in 1867, I had a condensing surface very large. It was equal in surface to a tube about twelve feet in diameter at one end and about eight or nine feet at the other, and about a hundred feet long. There was also a six-inch pipe about one hundred and fifty feet long. The condenser consisted
719 of about thirty-two pipes, three inches in diameter at one end and two inches in diameter at the other, each pipe about one hundred feet long. They were placed in a tank of water, as shown in the model which I have had made. Sometimes even this amount of condensing-surface was not equal to keep up a perfect condensation, and water was injected to complete it and keep the pumps cool.

Int. 25. How does this extent of condensing-surface required in the cast-iron still for distillation with vacuum compare with that which would have sufficed had no vacuum been used?

(Objected to as above.)

Ans. A pipe one hundred and fifty feet long, six inches at one end and four inches at the other, would have been amply sufficient for a still worked by the ordinary fire-process, with or without superheated steam. All the pipes alluded to in this and the last answer are of wrought-iron.

Int. 26. How much greater is the total amount of condensing-surface afforded by the condensing-pipes you described as used with your vacuum-still than that afforded by the condensing-pipes described in your last answer?

(Objected to as above.)

Ans. The vacuum-still has a condensing-surface of about 3,500 superficial feet. The condensing-surface described in the last answer not more than two hundred superficial feet, or about seventeen times as much in the vacuum-still as in the fire-still.

Int. 27. Will you explain why the benzine-fire which you used under your wrought-iron stills put up in 1867 and 1868, at the Eclipse Works, when your superheating apparatus was undergoing repair, had no injurious effect upon the lead joint of the man-head plates in the bottom of the stills, while a similar lead joint in the man-head plate of the cast-iron still at the time of the conflagration was melted so as to allow the oil to run out?

(Objected to as above.)

Ans. There are no man-heads on the bottom of my wrought-iron stills. The man-heads are placed on the tops of the stills, but those joints and other joints, even at and near the bottom, are made of lead. The reason they do not melt is that the benzine flame is very small, and the stills do not get heat enough to melt the lead. In the case of the cast-
720 iron still, the fire at the time of the conflagration was so great as to melt down the almost infusible bricks surrounding the still, let alone melting the lead.

Int. 28. It is stated by witnesses for the plaintiff that the wrought-iron stills put up by you at the Eclipse Works in 1867 and 1868 were of less cracking capacity than the cast-iron stills put up previously. Is this so; and, if not, will you explain why not?

(Objected to as above.)

Adjourned to meet at same place at 9½ a. m., June 4, 1872.

JUNE 4, 1872.

Met pursuant to adjournment. Present, as before.

Ans. I do not think it had a less cracking capacity if used in a cracking process than the cast-iron still, for the reason that the stand-pipe was made of sheet iron one-fourth inch thick, and that of the cast-iron still was made of cast-iron from three-fourths of an inch to one inch thick. The cast-iron still was covered with brick on edge grouted, (that is, its interstices filled with plaster,) and had a coating of plaster over the brick from one and a half to two inches thick, for the purpose of preventing condensation. The wrought-iron stills were made of one-fourth-inch iron and had a simple covering of brick, with plastered joints. Consequently, for cracking purposes, the advantage was in favor of the wrought-iron stills.

Int. 29. Will you state once more, for convenience of reference, the following measurements of the cast-iron still and the two wrought-iron stills, viz, greatest diameter, height from bottom of still to top of still, or beginning of stand-pipe, height and diameter of stand-pipe, and distance from lowest edge of goose-neck outlet to top of stand-pipe?

(Objected to as above.)

Ans. The greatest diameter of cast-iron still is ten feet; the extreme height from bottom to bottom of stand-pipe is ten feet four inches. The stand-pipe is eight feet long; from the top of stand-pipe to bottom of gooseneck outlet, twenty inches. The diameter of the stand-pipe is twenty-four inches; the diameter of the goose-neck twelve inches. The diameter of the wrought-iron stills is eight feet diameter, and twelve feet long. The stand-pipe of the wrought-iron stills were, I think, seven feet six inches in height, and two feet in diameter. From the
721 bottom of goose-neck outlet to top of stand-pipe, about twenty inches. The goose-necks are one foot in diameter.

Int. 30. Please state also the height of the uppermost, and that of the lowermost superheated steam-pipe from the bottom of each of the three stills, and the distance in each still from the bottom of the still to the level at which the oil would stand when cracking, if any would begin; supposing the oil to be introduced into the still in mass before distillation begun?

(Objected to as above.)

Ans. The height of the uppermost steam-pipe from the bottom of the cast-iron still is three feet four inches, and of the lowest pipe from the bottom of the still one foot ten inches. In the wrought-iron stills the lowest pipe was about one foot eight inches, and the uppermost three feet eight inches from the bottom of the still. The distance from the bottom of the still at which cracking would commence would altogether depend on its gravity, and on the wells from which the oil was obtained. Taking ordinary forty-four-gravity oil, with a full charge, say, of sixty barrels in the cast-iron still, cracking would commence about three feet to three and one-half feet from the bottom of the still. In the wrought-iron stills, with a charge, say, of ninety barrels, cracking would commence, I should say, about three feet from the bottom of the stills. It is presumed that the fire process had been used.

Int. 31. Supposing that cracking could have taken place in those stills as you used them, namely, with vacuum, would the figures you have given be the same?

(Objected to as above.)

Ans. It is not a supposable case; cracking could not have taken place in them.

Int. 32. What was the distance apart of the horizontal heated steam-

pipes in each of the two series, in the cast-iron and wrought-iron stills?

(Objected to as above.)

Ans. They were about one inch apart in both cast-iron and wrought-iron stills. In both directions, horizontally and vertically.

Int. 33. Would the cracking capacity of the cast-iron still be affected, or, rather, the conditions of cracking be affected, if you suppose
722 one of the two banks or series of superheated steam-pipes to be removed; the still and its mode of working remaining otherwise unchanged?

(Objected to as above.)

Ans. By bank, I suppose, you mean a box of pipes, which would be one-half of the heating surface, removed. If it were removed, evaporation would proceed more slowly, and if there were a tendency to cracking in a vacuum still, the reduction of rapidity of evaporation would promote cracking, if it could be accomplished under the conditions with which I used it.

Int. 34. You have said that using the cast-iron and wrought-iron stills with a vacuum, no cracking could have taken place. Please explain why this is so, and also what would have been the effect in the interior parts of the stills, if cracking had been practised?

(Objected to as above.)

Ans. In vacuum distillation the temperatures are much lower than when distilling under atmospheric pressure. Instead of retaining the vapors in the still for the purpose of letting them condense and be decomposed, they are carried over into the condenser as rapidly as they are evolved. The rapidity of distillation, with the lower temperature at which it is carried on, prevents decomposition. Were decomposition or cracking feasible in a vacuum still, the pipes would be rapidly choked up with carbonaceous matter; the transmission of heat to the oil in the still would be prevented by the scale and coke filling up the interstices between the pipes.

Int. 35. Mr. Atwood, on page 680 of the record, being asked whether if oil dropped upon the surface of the pipes were decomposed by the high heat to which it would be subjected, carbon would be deposited upon the surface of the pipe, answered that it would not necessarily, but that the excess of oil not decomposed would remove it or keep it in combination in a liquid form. Is this correct; and, if not correct, will you explain why not, and what would be the effect as to the formation of coke anywhere in the still of the supposed decomposition of the oil dropped upon the hot surface of the pipes?

(Objected to as above.)

Ans. It is not correct. If any decomposition were effected, minute particles of carbon would be distinctly visible in the residuum left in the still. I on one occasion ran eighty barrels of oil down to
723 three barrels of residuum in a vacuum still, and did not observe any separated carbonaceous particles in the residuum. If decomposition took place, carbonaceous matter would be distinctly visible. One of the chief values of my process of manufacture is that I to-day, and since 1867, have sold all my residuum at a very high figure, compared with the residuum of any petroleum refiner in the United States. These residuums I sell at from ten to twelve dollars per barrel for lubricating purposes, when the ordinary residuum of refiners, even did they make fifteen, twenty, or twenty-five per cent. of residuum, would only be worth two and one-half dollars to four dollars per barrel. I mention this merely to show the value of the products which I have left after the oils are distilled over.

Int. 36. Had cracking or decomposition been practised in either the cast-iron or wrought-iron stills, what would have been the effect upon the quantity or character of the heavy oil in the still?

(Objected to as before.)

Ans. It would have been black in color, full of carbonaceous particles, bad odor, and almost valueless for lubricating purposes.

Int. 37. State why the dropping of the oil upon the hot pipes could not have produced the decomposition referred to in the cast-iron or wrought-iron stills, working with vacuum as you did.

(Objected to as before.)

Ans. The oil dropped from the troughs on to the pipes in constant showers, so that the pipes had a constant film of oil over them. There was always more or less oil laying in the bottom of the still, which in a vacuum-still, worked in the manner I did, maintains a violent and constant ebullition, constantly washing through and through the series of pipes. So violent is this ebullition in a vacuum-still, that I have had large heavy pieces of cast-iron which were placed on the trough to keep them in position washed out of their place, and I had to make special provision to secure the troughs permanently; the bars of iron weighed from one hundred and fifty to two hundred pounds.

Int. 38. Did you in your cast-iron still make any special provision for the arrest of crude oil if it should be found going into the condenser? If so, what was the necessity for so doing, and what was the provision which you made?

(Objected to as above.)

724 Ans. I placed intermediate between the still and the condenser a pipe eight feet long and two feet in diameter. In this pipe was a diaphragm descending to within two or three feet of the bottom of the pipe. The vapors in passing from the still to the condenser were compelled to descend to the bottom of the diaphragm, and up again to the outlet from this intermediate pipe to the condenser. Any oil condensed in this pipe could be either permitted to flow to the condenser, or back again to the still. A glass tube some six feet long was placed on the outside of this pipe as a gauge, to exhibit the oil condensed in this pipe. In practice, the pipe leading from this intermediate pipe to the condenser was left open; for, in case of a boil over, it was not of much value towards arresting any of the crude petroleum, because of the rapidity with which it passed over.

Int. 39. What was the cause of the liability of the escape of the crude petroleum which this diaphragm-pipe was intended to provide for?

(Objected to as above.)

Ans. The rapidity of evaporation, and the tendency is greater with light oils than with heavy ones.

Int. 40. Since the testimony for the plaintiff was given in Boston to the effect that there were indications in and about the cast-iron still that cracking had been practised therein, have you examined the still to see if there were any such indications; and, if so, will you state the results of your inspection, referring also to the material exhibited in Boston by Mr. Abbott, and said by him to have been taken from the still?

(Objected to as before.)

Ans. I have examined the still and found some asphaltic deposit hanging in threads from the top of it; the bottom of the still shows yet the sand marks of the core when it was cast, the steam-pipes and interstices between them are free from carbonaceous deposit, and the steam-boxes are apparently as clean as the day they were put in. I may say the same of the two wrought-iron stills which were involved in the same

fire as the cast-iron one. The only other indication of cracking which I found in the cast-iron still was a small amount of tarry matter in the bottom.

725 Int. 41. What do you believe to have caused the asphaltic and tarry deposit to which you refer?

(Objected to as above.)

Ans. It was caused by the intense heat which the still was subjected to during the fire, acting on oil left remaining in the still.

Int. 42. How did the bulk of the oil that was in the still at the time of the fire escape from it, and how was it that any oil remained in the still?

(Objected to as before.)

Ans. The oil which was in the still at the time of the fire was probably forty barrels of heavy oil about twenty-six gravity. This oil escaped out of the still by the bottom connections being broken. The cavity in below the still was insufficient to hold that amount, consequently when the cavity below the still was filled up some amount of oil must have remained in the still, and, being subjected to the great heat that prevailed, produced the tarry matter in the bottom, and the asphaltic deposit I found adhering to the top of the still.

Int. 43. Did you in 1860 and 1861 design stills for various refiners in this neighborhood; if so, about how many, as nearly as you can recollect?

(Objected to as above.)

Ans. I designed, I should say, about thirty stills.

Int. 44. How did these stills compare in height of dome and standpipe with stills of same diameter which others builders were making or have since made?

(Objected to as above.)

Ans. When I came here, in 1861, there were only in Pittsburgh some eight or ten petroleum-stills; their capacity was very small, being from ten to twenty-five barrels each. The stills I designed in 1861 were from sixty to six hundred barrels each, so there were no stills here for me to compare the stills I constructed with. Mine had all stand-pipes from seven to twelve feet in height and from eighteen inches to three feet in diameter.

Int. 45. Mr. Charles Toppan, a witness for the plaintiff, testifies to an interview with you at Pittsburgh about the 3d of August, 1868, which he says took place at your refinery, and that you carried him through

726 your works on that occasion and showed them to him. Do you remember having an interview with Mr. Toppan about the time mentioned; and, if so, where did it occur?

(Objected to as above.)

Ans. Mr. Toppan is certainly laboring under a misimpression about seeing me at any time at my works, consequently I never took him through them. Mr. Toppan called at my works when I was absent. I believe I was at Smith's Ferry on that day. On the morning after he called I had to go to the city, and he called again at the works when I was away. He was, I understood, angry because I had not remained to keep the appointment which he himself made the previous day. He called at Mr. Kier's office in Pittsburgh after his return from his second visit to my works, but I was absent. On learning that he had called, I went to the Union Depot Hotel to find him. I saw him either then or shortly afterwards, and went to his room with him.

Int. 46. Did you ever carry him through your works, or show them to him at all?

(Objected to as above.)

Ans. Never.

Int. 47. I wish you would examine, on pages five hundred and ninety-four and five hundred and ninety-five of the record, Mr. Toppan's account of his journey about your works, and state whether it was possible that he could have gone where and as he says he did, and produce a plan of the works as they then were, to illustrate your answer.

(Objected to as above.)

Ans. I produce a plan of the works; it is marked "Exhibit 122, B. C. C., June 4, 1872." Mr. Toppan says, in answer to cross-interrogatory 106, that he was shown by the foreman two vacuum-stills with a passage-way between them; joining one of them was a large reservoir for oil— a tank. He carried me into the barrel-house or repair-house, whatever you call it. He says, in answer to cross-interrogatory 123, I think there was a roof over them. I do not see how Mr. Toppan could possibly have passed between any two vacuum-stills in my place on his way to the warehouse; nor was there a large tank. The vacuum-still house is marked so on the drawing, the three stills side by side, and the cast-iron still. The largest of the four stills in the vacuum-still house was not there at the time referred to. Between the wrought-iron stills and the cast-iron still was blockaded by the pipes leading from the
727 condensers to the vacuum-engine. These pipes were from three to four feet six inches from the ground. The space between the wrought-iron stills was filled up with brick-work. To pass from the office to the warehouse you had to pass through the private office, through a small yard, through the boiler-house, and past the engine-house, and across the main yard to the warehouse. He could have passed between the vacuum still house and the condensing-tank, but it was obstructed by pipes and overflow water from the condenser and seldom used.

Int. 48. Mr. Toppan says that in his interview with you you told him that your great object was to get burning oil distilled by the vacuum process, and that your great drawback was the per cent. of heavy oil which you had left, which you had only a limited market for, and that you told him that if they could use your dark, heavy oil it would be a great relief to you, and just what you would like to accomplish. Did you make any such statement to him in words or in substance?

(Objected to as above.)

Ans. I did not.

Int. 49. He further states that you said to him at this time, August, 1868, that you were making no light-colored oils that you could substitute for the Lightfoot Company's finishing and oiling-off oils, but you thought by a little management you might produce something that would serve them better than the oils they were then using. Will you state whether Mr. Toppan here correctly reports what you said? And if not, please to state it as it was.

(Objected to as above.)

Ans. I did not say to Mr. Toppan that I was making no light-colored oils, because I had several hundred barrels at the time he was here. I knew little or nothing at the time about oils adapted for tanners' use, and I may have told him that I might produce some oils that would serve them in place of those they were using. I had everything to learn from that period about tanners' oils.

Int. 50. Did you learn afterwards that the presence of paraffine liable to chill and crystallize in cool weather was objectionable for tanner's finishing oils?

(Objected to as before.)

Ans. I did.

Int. 51. Mr. Lightfoot testifies that he had a conversation with you
728 at Pittsburgh, in November, 1868, as follows: "I said that if we could get an oil as sweet as the stuffing oil which would be suitable for oiling off, it would be very desirable. He said that he did not know as we could do any better for the present than use the A. A. X. manufactured by Seccomb, Kehew & Thayer, but he thought he would soon be able to make an oil of as light a color as the A. A. X., and as sweet as the stuffing oil." Does Mr. Lightfoot correctly report what you said; and if not, will you state wherein he is wrong, and what you did say?

(Objected to as above.)

Ans. He may be correct, for this reason: At that time I had no paraffine presses in operation, so that I could separate the paraffine from my oils which they were rich in. I was about getting them in operation at that time.

Int. 52. Mr. Toppan says, "Dr. Tweddle wished one lot of oil (meaning Seccomb, Kehew & Thayer's oil) to be sent for his agent in Chicago. The agent's name I never knew. The Dr. always refused to give the names. I am very sure that it was five barrels of the finished oils that he wished for his Chicago agent." Did you say any such thing to Mr. Toppan as is here stated?

(Objected to as above.)

Ans. I do not remember having said so, but I may have wanted some of the oils as a sample for comparison.

Int. 53. Did you ever order five barrels for any purpose?

(Objected to as above.)

Ans. I do not remember; for whenever I hear of new products I usually send and purchase some.

Int. 54. It is testified by Edward W. Cobb, a witness for the plaintiff, that at a meeting between yourself and some of the directors of the Lightfoot Company at Philadelphia, in September, 1868, you agreed or were to agree that you would purchase the finishing oils of Seccomb, Kehew & Thayer, and pay the Lightfoot Company a royalty of three cents a gallon on all the oils so purchased. Did you ever agree or propose so to do?

(Objected to, as above.)

Ans. I did not. At the meeting referred to very little was said in my presence. When I left Philadelphia there was no understanding whatever. They were to make me a proposition, which they did
729 shortly afterwards, in the form of an agreement which Mr. Lightfoot brought to me, I think, to sign. It was objectionable. They may have brought or sent a second agreement which was equally so, when negotiations ended.

Int. 55. What was the objection?

(Objected to as above.)

Ans. It seems to me the objection was that I should purchase these light colored oils through the Lightfoot Company, and as I was making oils equally suitable and would be able to have them in the market shortly, it was objectionable that I should purchase them. I think there were some other objections in regard to territory. If I remember right, they wanted to debar me from the eastern part of Pennsylvania and New York market.

Int. 56. It is testified by Moses F. Winn, a witness for the plaintiff, that at this meeting in Philadelphia he had a conversation with you, in which the requirement of freedom from odor in stuffing and finishing oils was mentioned, and he says that he thinks you said that they

wouldn't be able to get any better oil in that particular than they got from Seccomb, Kehew & Thayer. Did you so tell him in terms or in substance?

(Objected to as above.)

Ans. I don't think I did. I may have told him that at that time they couldn't do better, as I was unable to furnish oil at that time free from paraffine. As to the odor, I had made oils previously equally as free from odor as those of Seccomb, Kehew & Thayer.

Int. 57. Mr. Malcolm C. Green, a witness for the plaintiff, testified that he never saw you in his office in New York. Were you present when Mr. Green gave his testimony in Boston?

(Objected to as above.)

Ans. I was.

Int. 58. Was Mr. Green the person you saw when you shewed samples of your neutral topaz oil at the Downer Company's office in New York, as testified by you in your former deposition?

(Objected to as above.)

Ans. He was not. It was some other person I took for Mr. Green.

Adjourned to meet at same place June 5, 1871, at 9½ o'clock a. m.

730 JUNE 5, 1872.

Met pursuant to adjournment. Present as before.

Int. 59. Did you make in 1868, and about what time, any oil intended for tanners' use from Smith's Ferry oil?

(Objected to as before.)

Ans. In 1868 I did not make any oil from Smith's Ferry oil intended for tanners' use; I made oil almost odorless from Smith's Ferry oil intended for lubricating oils. In the fall of the year I thought they might be well adapted for a tanners' oil for stuffing purposes, and, if I remember right, sold a few barrels to Chicago for that purpose. This oil had the light oils removed, and had the paraffine in solution in a non-crystallizable form.

Int. 60. When did you first see the finishing oil of Seccomb, Kehew & Thayer?

(Objected to as above.)

Ans. I saw them in the fall of 1868. They sent me a couple of sample bottles. I may have seen the oil at Toppan's room on his visit to Pittsburgh. Am not sure that he told me that Seccomb, Kehew & Thayer made the oils that he had.

Int. 61. Do you remember having any memoranda made by Mr. G. H. Christy, counsellor, of Pittsburgh, in relation to the agreement which you proposed to make with the Lightfoot Company with regard to the sale of oil under their patents?

(Objected to as above.)

Ans. Yes.

Int. 62. Do you remember whether or not this was done after you had examined and disapproved the draft of agreement proposed by the Lightfoot Company?

(Objected to as above.)

Ans. It was.

Int. 63. What was done with that memorandum after Mr. Christy made it?

(Objected to as above.)

Ans. He retained it.

Int. 64. Was it made under your direction?

(Objected to as above.)

731 Ans. It was.

Int. 65. Is there here present and will you produce the memorandum so made by Mr. Christy?

(Objected to as above.)

Ans. (Witness produces a memorandum, marked "Exhibit 123, B. C. C., June 5, 1872.)

Int. 66. You have spoken of the finishing oil of Seccomb, Kehew & Thayer seen by you in 1868. How did it compare in color, odor, fluorescence, et cetera, with the paraffine lubricating oil which you had previously made?

(Objected to as above.)

Ans. It was darker in color, it had a heavy blue and green color—that is, great fluorescence; in mine the fluorescence was very slight. Theirs had the peculiar odor which characterizes paraffine oils; mine had less odor, and an entirely different one. In gravity, theirs was probably twenty-six or twenty-eight Beaumé, while mine was thirty-three or thirty-five.

Int. 67. Mr. Merrill says, on page 639 of the record, "The products of distillation are so far modified by the use of steam in connection with fire, and by the use of steam, fire, and vacuum in combination, that the oil distils over more oily in body, with less decomposition or cracking, and but slight differences are observed in the color of the products distilled over. No perceptible difference in the odor of the oil is observed in those two processes last referred to." Will you state whether Mr. Merrill is right in this, and if not, will you state any practical experience of your own upon the subject?

(Objected to as above.)

Ans. Mr. Merrill is incorrect. When petroleum is distilled by naked fire, or by fire and superheated steam, it is more or less decomposed. Tar, coke, and non-condensible gases are inseparable from either process. The products in both cases have an offensive odor. There is less cracking in the operation when fire and steam or superheated steam are used in combination than when fire alone is used. When fire, vacuum, and superheated steam is used in combination there is no cracking, no non-condensible gases are formed, and the heavy products of distillation have very little odor when compared with those of the pre-
732 viously-named processes. The residuum of the distillation is of an oily, viscid character, and valuable as a lubricant. The paraffine distilled over is nearly white when separated from the oil, while the paraffine distilled over in the two first processes named are of an orange-yellow color, lighter or darker in character when separated from the oil. I have distilled hundreds of thousands of barrels of petroleum by fire and superheated steam, and I know that it is impossible to obtain as a result the rich, oily, valuable residuum by that process that is obtained by vacuum, steam, and fire. The fluorescence in the process of distillation by fire, and fire and steam process, commences to be distinctly visible in the blue shades when the illuminating oils are being distilled over. It increases rapidly toward the latter stages of distillation, when the greenish shade becomes very perceptible. When distilling by fire, steam, and vacuum in combination there is no perceptible fluorescence in the illuminating oils, and a very slight fluorescence is perceptible in the heavier oils. The almost imperceptible absence of fluorescence in the products of vacuum distillation is a peculiar characteristic of the process. At the Standard Petroleum Refinery, from 1862 to 1867, it was my practice to distil only by superheated steam and fire; toward the latter end of the distillations I practised the following

method to save the bottoms of my largest stills: I ran off the paraffine products rapidly. They were collected in what was known as the black oil tank. They were heavy paraffine oils. These oils I placed in smaller stills, and redistilled the oil, decomposing it into illuminating oils. These stills were provided with gauges, and I could not but be familiar with the fact that distilling off the lighter products from the paraffine oils deodorized them more or less. I had also three stills especially adapted for the distillation of tar. The products of these stills were treated in the same manner.

Int. 78. On page 643 of the record, Mr. Merrill, in replying to your testimony in regard to your treatment of the Barren County oil with sulphuric acid, makes certain statements in regard to the action of the acid in combination with the petroleum, which I will ask you to examine, and state whether he is correct, and give your reasons.

(Objected to as above.)

Ans. Mr. Merrill's statement in regard to the difficulty of separating the acid from the Kentucky oil when being treated with it, is entirely incorrect. In treating this lot of Kentucky oil there was no
733 difficulty whatever in separating the heavy carbonaceous matter. There was a difficulty in drawing off from the bottom of the agitator the tarry acid. It was so thick that it would not run through a pipe three inches in diameter from the bottom of the agitator, discovering which I immediately commenced to agitate the batch again, and it was with considerable difficulty that I was enabled to put the powerful machinery with which the agitator was furnished in operation again, the resistance to the stirring apparatus in the bottom of the agitator being so great; (the agitator was furnished with fan-like blades like the propeller of a steamship.) When I succeeded in getting the machinery in motion I continued the introduction of the requisite amount of sulphuric acid without cessation until I obtained the desired result. Next morning the oil was pumped into another agitator. At the bottom of the agitator I found a heavy carbonaceous mass which I had to take out with picks and shovels—the only time I ever had to do such a thing in the course of my experience. In the alkaline treatment I had no difficulty in separating the alkali before distillation. Mr. Merrill's assertion of the fact that these separations could not be effected is entirely theoretical.

Int. 69. Speaking upon the same subject, Mr. Merrill says that taking say, one hundred and eighty-one barrels, being the distillate which was pumped into the still for redistillation, it could not have been distilled distilled down to a residuum of only about five per cent. without having a considerable percentage of heavy oil mixed with the lighter burning oil, and leaving in the still a tarry and black residuum. Will you examine this part of his testimony also, being on page 646, and say how far he is in error here, if at all, and why?

(Objected to as above.)

Ans. Mr. Merrill is entirely incorrect. This oil was of a different character, and made under entirely different conditions than those in which ordinary petroleums are manufactured. I do not think that there was much heavy oil run over in the first distillation; in the second distillation I don't think there was any run over. The illuminating oil obtained had a singularly low fire-test, but I was so much pleased with the results obtained that we despatched a gentleman down to Kentucky and Tennessee to try and obtain a large quantity of it. It was almost worthless there, but the difficulty of building boats and running it down
734 either the Tennessee or Cumberland River prevented our get-

ting any of it. I have lately purchased a large amount of similar oil from Terre Haute, Indiana, and will be enabled to prove the accuracy of my statements as to the separation of the acid and alkali.

Int. 70. In your patent of December, 1867, No. 72126, you describe the temperature of the superheated-steam pipes as increasing in the successive stills. How does the temperature required in the last or lowest still, in which distillation of heavy oil takes place when conducted with vacuum as there described, compare with the temperature which would be required for effecting that distillation without vacuum, and whether with fire alone, or with fire and steam?

(Objected to as above.)

Ans. It requires a much less temperature.

Int. 71. Does it require a destructive or decomposing temperature?

(Objected to as above.)

Ans. It does not.

Int. 72. Mr. Merrill says on page 677, "Paraffine vapors always continue to come over freely from the distillation of the heavier portions of petroleum so long as any oil remains in the still, or until distillation ceases." Is this correct in the case of distillation with vacuum; and if not, will you state what, if anything, you have observed in your practice of vacuum distillation showing it to be incorrect?

(Objected to as above.)

Ans. The statement is incorrect. In vacuum distillation the paraffine almost ceases to come over some time before the end of the distillation is effected. The products get richer in paraffine up to a certain point, when they rapidly get poorer and poorer until a thick, heavy oil comes over, which, when frozen and pressed, leaves a glutinous semi-formed paraffine in the bags. The residuum left remaining in the still at this point does not solidify, in cold weather, in anything like the same manner had it been taken out before the paraffine had all come over. It is dark green in color, almost odorless. Even in fire distillation of petroleum tar the paraffine products are entirely over before distillation is fully completed. A substance resembling somewhat paranap'thaline seems to be substituted. It is a dense, waxy, orange-colored substance, which turns rapidly green on exposure to the air.

Int. 73. On page 667 Mr. Merrill says that in the apparatus
735 described in your patent of 1867 the temperature of the still where superheated steam is admitted into the pipes and into the body of the still itself, and with the aid of a vacuum apparatus, would not necessarily be lower than when a fire-heat is used in the ordinary manner; and that supposing the steam to be superheated to such an extent as to heat the pipes red-hot where the steam enters the still, the temperature of the still, even with the aid of a vacuum apparatus, would be in his judgment hotter than the temperature of the still when heated in the ordinary way by fire, for the reason, as he says, that when fire is applied to a still containing a regular charge of petroleum the temperature of the still cannot exceed the temperatures of the oil vapors being carried over, whilst in case where the pipes were heated by steam where it entered the still sufficiently hot to make them red, the temperature of the still would be much above the temperature necessary to distil the petroleum. Will you state whether Mr. Merrill is in error here, and, if so, why, and state what you have observed in vacuum distillation showing that he is in error?

(Objected to as above.)

Ans. Mr. Merrill is in error, for the reason that it is too well known a fact of fluids vaporizing at a lower temperature under a vacuum than

under atmospheric pressure to admit of discussion. In a still heated by fire the oil remains in an apparent quiescent state, whilst in a vacuum, with superheated steam, it is in violent ebullition. The oil in a fire-still is at a much higher temperature than the boiling-points of the decomposed products. In a vacuum-still there is not that difference between the boiling-points of the products and the oil in the still at the time of their volatilization, because they have not been decomposed. The cracked products at the end of a fire distillation are obtained sometimes as high as fifty or sixty degrees Beaumé, and have a low boiling-point compared with the oil in the still at the time they were produced. In regard to the red-hot superheated-steam pipe, it is not a correct indication of the heat of the steam passing into the still, for the steam is attenuated in its distribution in pipes, and the temperature consequently reduced. Were the steam-pipes in the still at a red heat, they would rapidly be coated with a carbonaceous deposit, and almost incapable of transmitting heat. Did such action take place, distillation could not be proceeded with. Asphaltum is an extremely poor conductor
736 of heat. To show how incorrect a red-hot pipe is of indicating the temperature of superheated steam, I mention this fact—that if you take a large superheating furnace when all the pipes are red-hot, and you pass steam through it moderately, you can secure good superheated steam. If you turn on a large amount of steam and allow it to pass rapidly out of the furnace, your steam is imperfectly superheated, and at the same time you will observe that the steam-pipes leading from the furnace will get hot gradually further and further from the superheating furnace, sometimes thirty or forty feet distant, and the apparently superheated steam you have been making is in reality imperfectly superheated.

Int. 74. Will you now examine the testimony given by Mr. Merrill in regard to his use of an experimental vacuum-still, being contained on pages 671 to 673 of the record, and state whether such a still, used as he describes, would afford any means of forming a reliable judgment in regard to the operation and results of distillation in vacuum as a practical manufacture; and, if not, why not?

(Objected to as before.)

Ans. It would not; although he might get an approximate idea of its value. In the first place, he only bricked up the still two-thirds of its height, leaving about twenty-four feet of its surface—I mean the top and side—exposed to the action of the air, which would have a tendency to condense the vapors forming in the still. Second. The dimensions of the grate were large enough for a furnace for a still with a capacity of at least fifty or sixty barrels, so little heat being rendered necessary under a vacuum-still when fire is used. He says at the end of the condenser, near the air-pump, upwards of eighty feet from the still, he placed his vacuum-gauge. In all my experience in vacuum distillation, and in the manufacture of sugar in vacuo for upwards of twenty years, I have always seen vacuum-gauges placed on the vacuum-still itself, or immediately near it. In its position near the pump it would not afford a correct indication of the vacuum in the still. The vacuum which his gauge indicated in the experiments which he made was about twenty-two inches of mercury, which would be higher than that in the still. I would not think of running my stills under a vacuum of less than twenty-seven to thirty inches. He also states that he used steam during the process of distillation, and superheated it by passing it through a coil of pipe immersed in the oil in the still. The pipe was twenty-five
737 feet long and two inches in diameter. The steam used was com-

mon boiler-pressure. It is absurd to suppose that the steam delivered through such a pipe, and into a vacuum, could possibly have time to be superheated. It was, in fact, introducing steam into the oil on the inside of the still, cooling the oil down while the fire on the other side was being forced, to keep the temperature up. The effect was, if any, to try and decompose the oil. The residuum in the second instance, he says, was run down to about "eighteen or twenty gallons," or twelve or thirteen per cent. of the oil which he put into the still. "It was very dark green in color, and had but little smell, but it was so very viscid that it was difficult to measure it with accuracy. There was no separated coke in it." Had he run down the same oil in a fire-still, under atmospheric pressure, with the same steam appliances, he would have had black tar and separated carbon. The tar would not have possessed anything like the same body or viscidity, nor would he have obtained the percentage of heavy oil from thirty-seven gravity down to twenty-eight, namely, thirty-five gallons. He says nothing about fluorescence in the products obtained.

Int. 75. In what stills or what sort of stills did you practise the process especially described in your patent of February, 1870?

(Objected to as above.)

Ans. In the same stills I built in the fall and winter of 1867 and 1868; the two wrought-iron stills and the cast-iron which I built in the winter and spring of 1867; also in stills built afterwards, of the same construction as the wrought-iron stills.

Int. 76. Will you produce a model made to a scale of the cast-iron still, as put up and used by you at the Eclipse Works in 1867?

(Objected to as above.)

Ans. I herewith produce the model, marked "Exhibit 124, B. C. C.," June 5, 1872. It is made on the scale of one inch to the foot. The condense-tank is made one half of the length it ought to be, to save room; the condensing-pipes being bent around instead of lying out straight.

Int. 77. Mr. Tappan, in his deposition on page 577, speaks of some oil received from Mr. Bartlett, in Boston, some time in August, 1868, after his return from Pittsburgh. Do you remember what that oil was?

(Objected to as above.)

738 Ans. I do not.

Int. 78. To return for a moment to the negotiations between yourself and the Lightfoot Company, will you state whether Mr. Lightfoot went with you to Mr. Christy's office, when the directions were given to him which are embodied in the memorandum Exhibit No. 123?

(Objected to as above.)

Ans. He did.

Int. 79. Was a draft of agreement prepared by Mr. Christy after the memorandum in question, and, if so, what was done with it?

(Objected to as above.)

Ans. There was. I sent it, I think, to Mr. Lightfoot or the Lightfoot Company.

Cross-examination by Chauncey Smith, esq., of counsel for complainant.

(De bene.)

Cross-int. 80. Will you give the number and dimensions of the superheating-steam pipes in the wrought-iron stills erected by you in the winter and spring of 1868 at the Eclipse Works?

Ans. One hundred and twenty-four pipes, two inches in diameter in-

side. The outside diameter would be about two and one-half inches, I think; not quite; each pipe ten feet long, as near as I remember.

Cross-int. 81. How many pipes were there in a vertical series?

Ans. Seven.

Cros-int. 82. In your previous examination you stated the number of pipes in a vertical series in the cast-iron still to be seven. Is that the correct number?

Ans. It is.

Cross int. 83. Will you look at your answers to the 30th and 32d direct interrogatories, and see if you have not made a mistake, either as to the distance of the uppermost pipes or the lowermost from the bottom of the cast-iron still, or as to their distance apart?

Ans. I think I have made a mistake. Instead of being one foot ten inches from the bottom, it should have been about one foot four inches from the bottom of the still.

Cross int. 84. In your answer to the 23d direct interrogatory you speak of redistilling four hundred or five hundred barrels of oil
739 in the cast iron still on one occasion. Can you give the number of barrels more definitely?

Ans. I cannot.

Cross-int. 85. In distilling that oil, did you flow the oil in continuously from the commencement of the distillation to the end, or did you put in charges of a given quantity which you distilled off one by one?

Ans. It flowed in almost continuously.

Cross-int. 86. In the account given in Exhibit No. 75, on pages 369 and 370, of a trial of the cast-iron still, it is stated that seventy-four per cent. of the crude oil was obtained in refined oil. Had the distillation then reached the point where it began to show color, or where it had become too heavy for refined oil?

Ans. It had reached that point some time previous to the distillation being stopped.

Cross-int. 87. How long previous?

Ans. I do not remember.

Cross-int. 88. All that seventy-four per cent. went into the refined oil, produced at that time, and which is certified to by the inspector's certificate at the bottom of page 370, did it not?

Ans. It did.

Cross-int. 89. In the circular which you published in 1867, and which is numbered Exhibit 77, and to be found on pages 371 to 375, I find at the bottom of page 373 this statement: "Last year Dr. Tweddle manufactured from about 90,000 barrels of crude petroleum 66,000 barrels of refined oil, or seventy-four per cent.; to obtain this percentage he redistilled the tar down to coke." Does this statement relate to your operations at the Standard Refinery for the year 1866?

Ans. It does.

Cross-int. 90. In obtaining this seventy-four per cent. did you crack the oil?

Ans. I did.

Adjourned to meet at same place on June 6, 1872, at 9½ a. m.

JUNE 6, 1872.

Met pursuant to adjournment. Present as before.

Adjourned until June 7, 1872, at 9 o'clock a. m.

740 JUNE 7, 1872.

Met pursuant to adjournment. Present as before.

(The witness wishes to correct his answer to cross-interrogatory 80, by saying 126 pipes instead of 124; and the answer to cross-interrogatory 81, by changing "7" to 9 as the number in a vertical series; there were two banks or boxes of pipes in the wrought-iron still, each containing 63 pipes, the same as in the cast-iron stills.)

Cross-int. 91. In the base of the model which you have produced of the cast-iron still, is the cavity or excavation under the still exhibited in its proper proportions?

Ans. It is exhibited as nearly as possible in its proper proportions, with this exception, that in the centre the cavity ought to be about two inches deeper in the model and the openings outward at the sides ought to be closed up. A piece of tin nailed over the openings of the side cavity would represent it more truly.

Cross-int. 92. In the model I find two large orifices in the bottom or saucer-shaped portion of the still. Will you state whether there were two such orifices in the still itself?

Ans. There were not; the one on the side was made so as to inspect underneath the pipes in the model.

Cross-int. 93. How did the oil which was in the tank at the time of the fire escape into the cavity below the still?

Ans. Since my last examination I found that an elbow in the pipe just below the man-head was split open. This still has just been taken down, so that it could not have been discovered very well before.

Cross-int. 94. Was the oil which escaped into the cavity below the still at the time of the fire burned under the still?

Ans. It was.

Cross-int. 95. When was the stand pipe separated from the top of the still?

Ans. I do not remember exactly, but should think some months after the fire.

Cross-int. 96. At what distance below the lowest of the superheated-steam pipes in the cast-iron still were the pipes which admitted steam directly into the still?

741 Ans. About six or eight inches at the most, and touched the bottom of the still at one extremity of each pipe.

Cross-int. 97. What was the number of orifices in each of these last-named pipes for the discharge of steam, and what was the size of the orifices?

Ans. I do not remember the number or the exact size. We usually put two or three rows of holes in each pipe, the holes in each row two or three inches apart; should say the holes were about one-fifth of an inch in diameter, but cannot remember exactly.

Direct resumed:

Int. 98. Please look at Mr. Merrill's answer to the 42d interrogatory, on page 659, and say in what particular, if at all, he is in error.

(Objected to as before.)

Ans. Mr. Merrill is in error in his reply. He states that "the illuminating oils, free from volatile and dangerous ingredients, would be produced in the second of the series of stills as described, or the last of such series if two or more were used." It can be produced in the first of the series; the last of the series produces heavy paraffine oils.

(The respondent here puts in evidence a certified copy of the file-

wrapper and contents in the matter of the patent of Dr. Tweddle, dated February 15, 1870.)

HERBERT W. C. TWEDDLE.

James Cuddy, (recalled.)

Int. 1. Since your last examination have you been to the Aladdin Oil-Works of Dr. Tweddle, and made an experiment there for the production of neutral topaz oil? If so, when?

(Objected to as before.)

Ans. I have; on Thursday, the 6th of June, 1872.

Int. 2. Did you find at Aladdin wrought-iron stills, said to be those which were formerly used at the Eclipse Works, Sharpsburg Bridge, and did you compare them in dimensions and construction with that in which you conducted the experiment referred to? If so, what was the result of that comparison?

(Objected to as before.)

742 Ans. I was shown the stills said to have been used at the works at Sharpsburg bridge, and measured them, and also measured the stills at the Eclipse Works at Aladdin, and found them to be similar in dimensions, both in length and diameter, and similar in construction.

Int. 3. In the still used for the production of the neutral topaz oil, which I will call, for convenience, the experiment-still, were there two boxes of superheated-steam pipes, or only one?

(Objected to as before.)

Ans. In the experiment-still there was only one.

Int. 4. How was it as regards the length of the stand-pipe; what was its entire length?

(Objected to as above.)

Ans. The length of the stand-pipe from the top of the still to the outlet-pipe leading to the condenser, was nine feet six inches.

Int. 5. Were you informed that it had been elongated recently?

(Objected to as before.)

Ans. I was told that it had recently been lengthened three feet.

Int. 6. Did you examine the superheated pipe where it leaves the furnace to ascertain how hot it was; and, if so, how hot was it?

(Objected to as before.)

Ans. I examined the superheated pipe where it leaves the furnace, by stripping off the cement, and found it sufficiently hot to ignite hemp and fine shavings, and small chips of pine.

Int. 7. Describe the stock which you used for this experiment.

(Objected to as before.)

Ans. I used Franklin petroleum, thirty-two gravity.

Int. 8. Did you inquire if there was any lighter-gravity petroleum on hand, and with what result?

(Objected to as before.)

Ans. I did, and was told by Mr. Freeman, the foreman of the works, that there was only two barrels of light petroleum on the premises.

Int. 9. What did you first do with this Franklin petroleum?

(Objected to as before.)

Ans. I measured off twenty-five barrels of it from a tank into a still separate from the experiment-still. It was a vacuum-still twenty-nine inches vacuum. Then had the still fired up and the light petroleum separated by distillation.

743 Int. 10. How was the heat applied—I mean what kind of heat?

(Objected to as before.)

Ans. The heat was superheated steam.

Int. 11. By the light petroleum which you say you separated by distillation do you mean the illuminating oil?

(Objected to as before.)

Ans. I do.

Int. 12. What percentage of the charge was this distillate?

(Objected to as before.)

Ans. About twenty-five per cent.

Int. 13. What did you do with the heavy oil remaining in the still?

(Objected to as before.)

Ans. The heavy oil was then transferred to what is called the experiment-still, running in through small spouts and over the superheated pipes in the usual manner.

Int. 14. Did it so run in continuously until it was all in?

(Objected to as before.)

Ans. It did.

Int. 15. How soon after it began to run in did the distillate begin to run from the condenser?

(Objected to as before.)

Ans. In ten minutes.

Int. 16. What percentage of the original charge of crude was this distillate?

(Objected to as before.)

Ans. About seventy-five per cent.

Int. 17. Do you mean adding the illuminating oil and the neutral topaz oil together made about seventy-five per cent. of the original charge?

(Objected to as before.)

Ans. The neutral topaz had not yet been formed.

Int. 18. When I say topaz oil I refer to the distillate from the experiment-still obtained by running in the oil upon the superheated pipes after it had had the illuminating oil removed. How much of this topaz oil did you so obtain by distillation?

(Objected to as before.)

744 Ans. About fifty-five per cent. from the experiment-still.

Int. 19. After the topaz oil had been so distilled what remained in the experiment-still?

(Objected to as before.)

Ans. There remained a heavy, viscid, green oil called axle oil.

Int. 20. What was done with that?

(Objected to as before.)

Ans. It was run out into its own tank.

Int. 21. How many inches vacuum was maintained in the experiment-still during the distillation of the topaz oil?

(Objected to as before.)

Ans. Thirty inches.

Int. 22. After obtaining the topaz oil what did you do to it?

(Objected to as before.)

Ans. Washed it with sulphuric acid, caustic soda in solution, and warm water.

Int. 23. About what time yesterday did you arrive at this point?

(Objected to as before.)

Ans. Got the distillation finished at five o'clock; the washing finished at six o'clock.

Int. 24. In admitting to the experiment-sill the oil from which the

illuminating oil had been removed how was the cock which regulated the rate of admission set?

(Objected to as before.)

Ans. One-quarter open.

Int. 25. Did you preserve samples of the neutral topaz oil produced as you have described, and also of the heavy viscid oil which remained in the still?

(Objected to as before.)

Ans. I did.

Int. 26. What was done with the neutral topaz oil so produced after you took your samples?

(Objected to as before.)

Ans. It was run into the receiver generally used for receiving topaz oil.

Int. 27. Will you produce the samples you have of the neutral
745 topaz oil and of the heavy residual oil, and also, if you have it, a sample of the topaz oil regularly manufactured at the Aladdin Works and on hand yesterday?

(Objected to as above.)

Ans. I produce them. They are marked as follows: Neutral topaz oil manufactured yesterday in experiment-still Exhibit 126 and Exhibit 127, two samples. Heavy residual oil manufactured yesterday, Exhibit 128 and Exhibit 129, two samples. Neutral topaz oil already on hand at Aladdin Works, Exhibit 130, one sample.

Int. 28. Have these samples been in your possession ever since you took them until you now produce them?

(Objected to as before.)

Ans. They have.

Int. 29. I observe that the oil in Exhibit 126 and 127 is at this time cloudier than the oil in Exhibit 130. How is that appearance to be removed?

(Objected to as before.)

Ans. By exposure to light and the heat of the sun for a day or two.

Int. 30. In your judgment, did any cracking take place in the production of the topaz oil of which Exhibit 126 and 127 are samples?

(Objected to as before.)

Ans. No.

Cross-examination by Chauncey Smith, esq., of counsel for plaintiff:

Cross-int. 31. If I understand your answer to the 18th direct interrogatory, the fifty-five per cent. of topaz oil which you say you obtained is fifty-five per cent. of the amount introduced into the experiment-still?

Ans. The fifty-five per cent. alluded to means from the whole quantity of crude petroleum used.

Cross-int. 32. That, then, left about twenty per cent. of residuum?

Ans. Twenty per cent.

Cross-int. 33. What was the gravity of the distillate running off at the time when you stopped producing illuminating oil?

Ans. I took the gravity of the illuminating oil just before it ceased to run. The gravity was *the* thirty-eight.

746 Cross-int. 34. What was the gravity of the residuum when you stopped producing burning oil?

Ans. Twenty-nine degrees.

Cross-int. 35. How long were you in distilling off the illuminating oil?

Ans. Three hours.

Cross-int. 35½. What kind of a still was this done in?

Ans. In a wrought-iron still, twelve feet long, eight feet diameter, worked by superheated steam and vacuum.

Cross-int. 36. Was the whole twenty-five barrels introduced at once?

Ans. No, sir; it occupied forty minutes charging.

Cross-int. 37. What was the gravity of the neutral topaz distilled when it commenced running, and when you stopped running?

Ans. When it commenced running, thirty-five degrees. At the close of the operation, thirty-one and one-half degrees.

Cross-int. 38. How long a time was required for distilling the neutral topaz?

Ans. Two and one-half hours.

Cross-int. 39. What was the gravity of the residuum left after the end of the distillation?

Ans. Twenty-five degrees.

Cross-int. 40. Did the residuum accumulate in the bottom of the still until the end of the distillation?

Ans. Yes.

Cross-int. 41. What was the distance from where you took the temperature of the steam-pipe to the point where the pipe entered the still?

Ans. About four or five feet.

Cross-int. 42. Will you state the gravity of the illuminating oil which you obtained, and of the neutral topaz oil?

Ans. The gravity of the illuminating oil was thirty-eight; the neutral topaz oil thirty-two and one-half.

Cross-int. 43. What was the gravity of the illuminating oil when it commenced running off?

Ans. I did not take a test at that time; some time afterwards.

747 Cross-int. 44. At what temperature did you take the gravities you have given?

Ans. Some at eighty degrees and some at ninety degrees, but they are all rated at sixty of Fahrenheit.

Cross-int. 45. What was the gravity of the illuminating oil at the first measurement which you made?

Ans. I made only one test, and then it was thirty-eight.

Cross-int. 46. Was that the gravity of the whole mass which had been distilled to that time, or the gravity of what was running at the moment of the test?

Ans. The gravity of what was then running.

Cross-int. 50. Did you take the gravity of the whole mass of illuminating oil after it had stopped running?

Ans. No.

Direct resumed:

Int. 51. How long had the neutral topaz distillate been running when you took your samples of it?

Ans. About an hour and a half when I took the samples that we washed—those that are here produced.

Cross-examination resumed:

Cross-int. 52. In your answer to the 14th direct interrogatory you say you run the oil into the experiment-still continuously until it was all in. Do you mean that you were running it in continuously during the whole time that the neutral topaz oil was being distilled off?

Ans. No; the time occupied in running in was twenty-five minutes.

JAMES CUDDY.

Deposition of J. I. Livingston, taken, subscribed, and sworn to before B. C. Christy, esq., notary public and special examiner.

Direct examination by Causten Browne, esq., counsel for respondent:

Int. 1. What is your name, age, residence, and occupation?

Ans. J. I. Livingston; reside in Pittsburgh; aged thirty-three years; engaged in the oil-refining business. I have been in the business for eight years.

748 Int. 2. Were you present yesterday at the experiments just described by Mr. Cuddy in his deposition?

Ans. I was.

Int. 3. Have you read a portion of that deposition, and heard the remainder?

Ans. Yes.

Int. 4. Is Mr. Cuddy's account of the experiments correct?

Ans. Yes.

J. I. LIVINGSTON.

Dr. TWEDDLE recalled:

Int. 1. Were you present at Aladdin yesterday when the experiments were made which Mr. Cuddy has described in his deposition to-day?

(Objected to as before.)

Ans. I was.

Int. 2. Have you heard his deposition?

(Objected to as before.)

Ans. I have.

Int. 3. He states a comparison in dimensions and construction between what he calls the experiment-still and certain wrought-iron stills which he says were "said to be those which were formerly used at the Eclipse Works, Sharpsburg bridge." Were they those which had been so used?

(Objected to as before.)

Ans. They were the same stills.

Int. 4. He says that he was informed that the length of the stand-pipe from the top of the still to the outlet-pipe had been recently increased three feet. Had it been so increased?

(Objected to as before.)

Ans. It had.

Int. 5. Was there any lighter petroleum at the works than that which he used in his experiment, except two barrels?

(Objected to as before.)

Ans. There was not.

749 Int. 6. How did the conditions under which neutral topaz oil was produced yesterday (as described by them) differ, if at all, from those under which you produced neutral topaz oil in 1867, by continuously running the oil (from which the illuminating oil has been removed) continuously over the superheated-steam pipes, as described in your deposition given last summer?

(Objected to as before.)

Ans. They were the same conditions.

Int. 7. In the working of the experiment-still yesterday, as he describes it, did any cracking or decomposition take place in the still; and, if not, will you state how the characters of samples 126, 127, 128, and 129 show (if they do) that there was not?

(Objected to as before.)

Ans. There was no cracking. There is no carbonaceous matter in

128 and 129; there is hardly any fluorescence in 126 and 127, and they are all very free from bad odor.

Int. 8. How long after the crude petroleum began to run into the first still employed by Mr. Cuddy did the illuminating-oil distillate begin to run?

Ans. About twelve minutes.

Int. 9. Mr. Cuddy says there was but one box of superheated steam-pipes in the experiment-still, so called; what had been done with the other?

Ans. Some time ago the box and pipes got out of position, and the pipes had to be taken out so as to get the box in position again, and they have not been replaced again. The box that was used was like the ones I have already described as having sixty-three pipes and ten feet long each. The holes in the oil-distributing pipes, answering to the missing box of pipes, were plugged up before yesterday. The blow-pipes under where the missing box stood were still there, and admitted steam as usual.

HERBERT W. C. TWEDDLE.

750 *Deposition of John Gracie, taken, subscribed, and sworn to before B. C. Christy, esq., notary public and special examiner, June* 4, 1872.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. John Gracie; age, thirty-nine years; reside in Pittsburgh, and am a petroleum refiner.

Int. 2. If you know Dr. Tweddle, of Pittsburgh, how long have you known him?

Int. 3. I know him, and have known him about eleven years.

Int. 3. How long have you been a petroleum refiner, and in what part of the country?

Ans. About eleven years. In Pittsburgh and Oil City.

Int. 4. Have you been during that time practically familiar with what is called the cracking process for obtaining the maximum of illuminating-oil from a given charge of petroleum, and with the construction of stills in which cracking was to be practised?

Ans. For only a portion of that time I have been familiar with the cracking process. I suppose, probably, say, for ten years of that time.

Int. 5. What is the effect of bricking over the outside of the still up to, say, the bottom of the stand-pipe, as regards cracking the oil vapors by condensation against the inside of the still?

Ans. It prevents cracking of the oil.

Int. 6. What is the custom in the construction of stills designed for cracking as to this matter of covering or leaving uncovered the outside of the still?

Ans. For manufacturing illuminating-oil, where it is necessary to decompose or crack the heavy or paraffine oil, the still is left uncovered or exposed.

Int 7. Assuming two stills, one having a wrought-iron stand-pipe a quarter of an inch thick, the other having a cast-iron stand-pipe three-quarters of an inch thick, neither stand-pipe having any external casting, and both of them exposed to the cooling influence of the
751 outer air, and both stand-pipes of the same length, which of the two would be most favorable for cracking?

Ans. The wrought-iron or thin one.

Int. 8. Suppose the cast-iron one to be eight feet long and the wrought-iron one to be six feet long, how far would that difference in the length of the two practically affect the advantage enjoyed by the wrought-iron one in the matter of cracking?

Ans. Under the conditions given before, both being exposed, the cast-iron one being three-quarters of an inch in thickness, the wrought-iron one-quarter of an inch in thickness, the wrought-iron one will crack or decompose best or better than the other or heavier pipe.

Int. 9. Do you know whether Dr. Tweddle has designed a good many stills for refiners in this neighborhood during the last ten years?

(Objected to as not being competent in rebuttal to any testimony heretofore offered by complainant.)

Ans. I do not. I have not knowledge of any during the last ten years, except for himself.

Int. 10. Do you know of his building a good many in 1860 or 1861?

(Objected to as before.)

Ans. Yes, sir; I know of numerous refineries and stills designed by Dr. Tweddle in the years 1860 and 1861.

Int. 11. What was his practice compared with that of other designers of stills as to the height of his stills relatively to their diameter?

(Objected to as before.)

Ans. Dr. Tweddle's practice has been to put on his stills larger domes and goosenecks than any other refiner or builder that I am acquainted with or know of.

Int. 12. Did he build for Lockhart & Frew, in 1860 or 1861, two cast-iron stills of about seventy barrels capacity?

(Objected to as before.)

Ans. He did.

Int. 11. Will you give as near as you can the diameter of the still, the height of the still to the bottom of the stand-pipe, and the height or length of the stand-pipe?

(Objected to as before.)

752 Ans. The stills were about eight feet in diameter in the inside, and from the bottom to the stand-pipe was between nine and ten feet, probably ten feet, and the stand-pipe was, I think, nine feet in height and twenty-four inches in diameter.

Cross-examination by Chauncey Smith, esq., counsel for plaintiff:

Cross-int. 14. In your practice in refining oil, when you reach the point in distilling the charge at which it becomes necessary to crack the oil, do you have to make any change in the management of the fires? If so, what is the change?

Ans. In my practice in refining oil, when it reaches the point when it is necessary to crack the oil, we throw it, the vapors, to a great height, through a stand-pipe or dome in which the heavy oils are condensed and brought back into the still. If that is not sufficient, we turn a steam jet against the current of vapor to drive the vapors back into the still. If that is not sufficient, we reduce the heat under the still.

Cross-int. 15. How do you determine when you have reached the point when it is necessary to make these changes in order to crack the oil?

Ans. By the color of the distillate.

Cross-int. 16. The distillate then becomes yellow, does it not, or darker than the refined oil which has been previously running off?

Ans. It does.

Cross-int. 17. Has it been your practice in distilling to carry on the distillation until the residuum in the still was brough to dryness, forming a hard deposit of coke on the bottom of the still?

Ans. No, sir.

Cross-int. 18. What has been your practice in regard to the extent to which you carry the distillation; that is, what percentage of the original petroleum remains in the still as a residuum after you have stopped the distillation, and what is the character of that residuum?

Ans. It depends upon the size of the stills. The amount of residuum remaining in a still will depend, in the first place, upon the gravity of the crude material charged in the still. In small stills of light oil, there would be from three to five per cent of residuum. In larger stills, or in large stills, from five to ten per cent., according to the gravity of the crude oil.

Cross-int. 19. What sized still are you using now, and what gravity of petroleum are you distilling?

753 Ans. I am using fifteen-hundred-barrel stills; gravity of crude oil varying from thirty-five to forty-nine degrees Beaumé.

Cross-int. 20. In those stills, when using petroleum of forty-two to forty-three degrees gravity, at what point in the process of distillation do you find it necessary to commence cracking the oil; what amount of refined petroleum do you obtain, and what amount of residuum, and what is the character of that residuum?

Ans. We find it necessary to commence the cracking at about forty-four degrees gravity. It will depend a good deal upon the district from which the oil comes, and the price of residuum, the amount we leave in the still. That would consequently leave the product of refined oil greater or less, in proportion to the amount of residuum left in the still.

Cross-int. 21. Cannot you give me a statement more definite as to the amount which would be distilled over before reaching the cracking-point, with oil of from forty-two degrees to forty-three degrees gravity in your stills, as now using them?

Ans. I don't think that I can; the quality of the oil from each producing-district varies as to the amount of paraffine contained in the crude oil.

Cross-int. 22. Can you tell me about what percentage of residuum you are now obtaining from the oils which you are distilling?

Ans. With a view of redistilling the residuum we are, and have been for some time, leaving from eight to ten per cent.

Cross-int. 23. And you crack the oils before reaching that percentage, do you not?

Ans. Yes, sir.

Cross-int. 24. What is the character of that residuum; what is its appearance and gravity?

Ans. It is of a dark-brown or walnut color, and gravity twenty-five degrees or twenty-six degrees.

Cross-int. 25. Have you recently sold a large quantity of that residuum to the Downer Oil Company of Boston?

Ans. We have.

Cross-int. 26. What percentage of the crude petroleum do you obtain of illuminating-oil before obtaining that residuum?

754 Ans. Cannot answer that question in that shape; I might give the result of one run.

Cross-int. 27. Cannot you tell about what percentage you would obtain, or what percentage on an average?

Ans. Yes; we would expect about seventy-five per cent. of illuminating-oil.

Direct resumed:

Int. 28. To the production of what kind of oil was the attention of

petroleum manufacturers in this part of the country mainly directed in the year 1867, and why?

(Objected to for the same reasons as stated in the previous examination in chief.)

Ans. As near as I remember, it was devoted exclusively to the manufacture of illuminating oil. I am not able to answer that, not having given any attention to the manufacture of any other than illuminating-oil.

Int. 29. What was the extent of the refining-works with which you were connected in 1867. I mean what was your capacity per week of production, and how did your works compare in extent with others in this neighborhood?

Ans. I can't exactly place the date of our extensions and improvements, but think our capacity was about one thousand barrels per day. They were the Brilliant Oil Works of Lockhart, Frew & Co.

JOHN GRACIE.

Deposition of George H. Christy, taken, subscribed, and sworn to before B. C. Christy, esq., notary public and special examiner, June 6, 1872.

Direct examination by Causten Browne, esq., counsel for respondents:

Int. 1. State your name, age, residence, and occupation.

Ans. George H. Christy; age, thirty-five years; residence, Luickley Borough, Alleghany County, Pennsylvania; occupation, counsellor at law, practising in Pittsburgh.

755 Are you partner of William Bakewell, esq.?

Ans. I am.

Int. 3. Is Mr. Bakewell now absent from Pittsburgh, and why?

Ans. He is, on account of sickness. He was taken sick about three weeks ago.

Int. 4. Do you remember being consulted by Dr. Tweddle in regard to an agreement to be made between himself and the Lightfoot Co., of Boston, in regard to a license by which he could sell paraffine oils to be used by tanners under patents of that company? If so, will you state whether you prepared a draft of agreement in pursuance of such consultation, and when this was done?

Ans. I remember of being consulted by Dr. Tweddle on that subject. I either prepared a draft of an agreement in pursuance of such consultation, or else an amended one, or both, which had previously been prepared, and my recollection is that I wrote out an agreement in full. I fix the date as being in October or November, 1868, by reference to the file-wrapper which I made at the time, in which to file away any papers or memoranda which might appertain to that item of business, and also by the date, as it appears on our books, of the charge I made for drawing the agreement, and which date was November 30, 1868. The entry is as follows: H. W. C. Tweddle, Dr. to fees drawing agt. with Lightfoot Currying Oil Co., $20.00.

Int. 5. Did you preserve and is there here present the memoranda, if any, which you made of your consultation with Dr. Tweddle before drawing the agreement? If so, will you produce or refer to it?

Ans. I have here a memorandum, marked "Exhibit 123, B. C. C., June 5, 1872," which I made at the time and in connection with the consultation or consultations with Dr. Tweddle, above referred to; it is in my own handwriting.

Int. 6. Was Mr. Lightfoot at you office with Dr. Tweddle at the consultation or consultations referred to?

Ans. My recollection is that a gentleman was present at one and perhaps more of those consultations, who was introduced to me by Dr. Tweddle as Mr. Lightfoot, and who answered to that name.

Int. 7. Was this agreement of license with the Lightfoot Company made, or negotiations for such license entered upon, in pursuance of
756 any advice from you to Dr. Tweddle as to the necessity of such a license to enable him to do what he proposed to do?

(Objected to as not being in rebuttal of any testimony offered by the complainant in reply to the defendants' testimony.)

Ans. The agreement that I drew was drawn up in pursuance of advice so given by me to Dr. Tweddle with reference to the necessity stated in the question.

Int. 8. What was it that the doctor told you he proposed to do?

(Objected to as above.)

Ans. As I recollect it—and my recollection on that point is very clear—Dr. Tweddle wished, as he then stated to me, to sell either some oils he was then making, or else some oils he was then proposing to make, I do not remember which, to tanners and curriers—such oils to be used by them in the processes described in the Lightfoot patents. He also desired that the packages containing such oils should be accompanied by such sanction or authority from the owners of the Lightfoot patents as would authorize his, Tweddle's, venders to use such oils, so purchased from Tweddle, in the processes described in the Lightfoot patents.

GEORGE H. CHRISTY.

JOSEPH CLARK recalled.

Int. 1. What was the occasion of your laying the benzole-pipe, by Capt. Brereton's direction, under the still at Aladdin?

(Objected to as above.)

Ans. The reason why I put the benzole-pipe under the still by Brereton's orders was that I could not get heat enough from my boiler superheater, owing to the superheater being out of order. It was leaking steam very badly, and we had a great deal of trouble with it. When he first spoke of putting it in was when our steam-boiler first gave way.

Int. 2. It is testified by Herman Keller, speaking of the wrought-iron stills at Sharpsburg bridge, that there was not enough pressure to heat the oil. Do you know anything of this?

(Objected to as above.)

Ans. I do. We hadn't enough of heat to heat the oil.

757 Int. 3. What was the cause of that?

(Objected to as above.)

Ans. It was also owing to our superheater being out of order, leaking steam very badly.

Int. 4. Was there any trouble with the vacuum engine of the cast-iron still when that still was first put up and set to work?

(Objected to as before.)

Ans. There was. We experienced a good deal of trouble with the vacuum engines for about a week or ten days after we first got started. That was owing to sand and pieces of iron that got washed into the pump.

Int. 5. Keller testifies that in using the two wrought-iron stills the cast-iron still was used for first heating up the oil. Is that so?

(Objected to as before.)

Ans. It is not so.

Int. 6. What were Keller's duties at the Sharpsburg bridge refinery, and what means had he of knowing anything about the distilling work that was going on?

(Objected to as before.)

Ans. His duties principally was working in the machine-shop, and there was no person had any opportunity of knowing what was going on except the men employed directly on the still. All others were prohibited from going there.

Int. 7. (De bene.) Mr. Abbott, a witness for the plaintiff, puts in with his testimony a memorandum, which he says he made of what you said to him at the time of your talk at the Union Depot Hotel, in which memorandum this occurs: "Never got up anything near like the samples in the little still or before I went to Aladdin;" meaning that Dr. Tweddle never before you went to Aladdin got up anything near like the samples of Merrill's deodorized oil and Tweddle's spindle oil which Abbott had there in the room with him at the time. Did you say that, in words or in substance, to Mr. Abbott?

(Objected to as before.)

Ans. I did not.

Int. 8. Did Abbott read to you or show you the memoranda he put down?

(Objected to as before.)

758 Ans. He did not. I know nothing about what he put down.

Int. 9. Speaking of your second interview that day, Abbott says that you said that Dr. Tweddle would rather you were dead than to tell what you knew in regard to the matter. Did you say that, in words or in substance?

(Objected to as before.)

Ans. I did not.

Int. 10. He says, "I reminded him that he was not at work for Dr. Tweddle then. He said that the parties were under Dr. Tweddle's influence. I then showed him that if they did remove him, there were enough other refineries in Pittsburgh where he could get work." "He said that these oil-men were all linked together; that he had just got his family settled down, or made some allusion to his family being settled down, and that if he got the ill-will of the Dr., he was sure of being broken up." Did you say this to him in words or in substance?

(Objected to as before.)

Ans. I did not. I remember of saying to him on the bridge about my family being settled down, when he talked to me of going to work at Corry for those parties that had a refinery there, and I didn't wish to move them.

Int. 11. Mr. Charles Toppan, a witness for the plaintiff, says that he came to the Eclipse Refinery, near Sharspburg, about the 3d of August, 1868, bringing samples of tanners' oil, a dark-colored and a light-colored paraffine oil, and had an interview, which he describes, with the foreman. Were you the foreman there at the time, and do you recollect his visit?

(Objected to as before.)

Ans. I was the foreman. I do recollect a visit of a gentleman about that time. I didn't know his name. He brought the samples.

Int. 12. Did he leave the samples with you and afterwards get them again?

(Objected to as above.)

Ans. He did.

Int. 13. He says that you carried him through the works, and showed him what refined oil you had on hand. Is that true?

(Objected to as before.)

Ans. It is not true.

759 Int. 14. Did you carry him through the works, or into the works at all?

(Objected to as before.)

Ans. I did not.

Int. 15. He says that the foreman said that the light-colored oils, meaning the light-colored oil like the sample he had with him, he was not making. Did you say that to him in words or in substance?

(Objected to as before.)

Ans. I did not.

Int. 16. He says that he visited the refinery again the next day and met Dr. Tweddle there, and was carried by him through the works. Was Dr. Tweddle at the refinery the next day?

(Objected to as before.)

Ans. Not to my knowledge, he was not. If he had been there I should have seen him.

Int. 17. Was this gentleman, whom I suppose to have been Mr. Toppan, with Dr. Tweddle at the refinery at any time, to your knowledge?

(Objected to as before.)

Ans. He was not.

Int. 18. Mr. Toppan says that as he entered the works the first thing he saw that the foreman showed him was what the foreman called two vacuum stills with a passage-way between them, and that he, Toppan, went through the passage-way between the two stills to the barrel-house or repair-shop. Will you examine the plan, Exhibit 122, and say whether it correctly represents the works as they then were?

(Objected to as before.)

Ans. The plan represents it about correct. The large still in the still-house was not there at the time. The two wrought-iron stills and cast-iron still are here, marked, respectively, "1, 2, and 3."

JOSEPH CLARK.

Adjourned to meet at same place on Friday, June 7, 1872, at 9 a. m.

760 *Exhibit* 123.—*B. C. C., June* 5, 1872.

1st. Whereas as in agreement.

2nd. Whereas Herbert W. C. T., of Pitts., is engaged in manufacturing oil such as is suitable for use in the processes described in the letters-patents hereinbefore mentioned, and is desirous of acquiring such rights under the several letters-patents granted to B. H. Lightfoot, as aforesaid, as will authorize him, the said Tweddle, his heirs, assigns, agents, and vendees to use such oil as he, the said Tweddle, his heirs, assigns, may manufacture, in any or all the processes described in the said letters-patent granted to said Lighfoot.

"Improved stuffing oil, manufactured by H. W. C. Tweddle, Eclipse Refinery, Pittsburg, Pa., licensed by Lightfoot's Currying Oil Company, for use under letters-patents granted to B. H. Lightfoot, Nov. 17, 1863, Dec. 22nd, 1863, and June 14th, 1864," except on packages containing finishing or coloring oil, and then on such packages the same marks shall be attached, with the word "finishing and coloring" shall be substituted for "stuffing."

Exhibit 125.—*B. C. C., June* 7, 1872.

The U. S. Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in the matter of the letters-patent granted Herbert W. C. Tweddle, dated February 15th, 1870, No. 99975, for "imp't in the manufacture of paraffine and paraffine oils.

In testimony whereof I, Samuel A. Duncan, Acting Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this twenty-sixth day of June, in the year of our Lord one thousand eight hundred and seventy-one and of the Independence of the United States the ninety-fifth.

[SEAL.] SAMUEL A. DUNCAN,
Acting Commissioner.

761 PITTSBURG, PA., *Jan.* 24, 1870.

To the Commissioner of Patents:

Enclosed please find application of H. W. C. Tweddle, for letters-patent for an improvement in manufacture of paraffine and its oils, with specification and certificate of deposit for fifteen dollars, the fee payable thereon. No model or drawing needed.

Very respectfully,

BAKEWELL & CHRISTY.

To the Commissioner of Patents:

The petition of Herbert W. C. Tweddle, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, respectfully represents that your petitioner has invented a new and useful improvement in the manufacture of parraffine and paraffine oils which he verily believes has not been known or used prior to the invention thereof by your petitioner. He therefore prays that letters-patent of the United States may be granted to him therefor, vesting in him and his legal representatives the exclusive right to the same upon the terms and conditions expressed in the act of Congress in that case made and provided, he having paid fifteen dollars into the Treasury and complied with the other provisions of the said act. He further prays that Bakewell & Christy, of Pittsburg, in the State of Pennsylvania, may be recognized as his attorneys in the matter of this application for a patent; hereby authorizing them, or their accredited agent, to transact all business with the office relative thereto; to sign the name of your petitioner to the drawings; to alter and amend the specification; to withdraw the application, or to appeal in case of rejection, as they may deem advisable; to receive the patent when granted, and generally to do all matters and things needful in the premises as fully, to all intents and purposes, as your petitioner could do.

HERBERT W. C. TWEDDLE.

[50-ct. stamp cancelled.]

762 *Specification.*

To all whom it may concern:

Be it known that I, Herbert W. C. Tweddle, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful improvement in the manufacture of parraffine and parraffine oils, and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the distillation of petroleum or other hydrocarbon oils, which can be made to yield a considerable percentage of paraffine, and consists in so carrying on the process of distillation that little or none of the paraffine will be decomposed, but most or all of it will pass over as vapor, and condense in the distillate, from which it may then be separated by cold and pressure.

Previous to the date of my invention the efforts of oil manufacturers were chiefly directed to securing from the crude oil the largest possible percentage of illuminating oil, in which oil the presence of paraffine was objectionable.

Since the early history of oil distillation a fire heat of high temperature has been commonly applied to the outside of the still.

When from 45 to 60 per centum of the oil was thus distilled over, the distillate marked 43° or 44° Beaumé hydrometer, and was yellow in color and objectionable in odor. In order to obviate these objections, various devices were adopted, such as high domes, goose-necks, etc., the immediate object being to decompose the heavier oils which contained the paraffine and prevent them from passing over into the condenser, as a result of which change the product was made lighter both in gravity and color.

By the use of such appliances, the vapors of the heavier oils which contain the paraffine are condensed in the dome or goose-neck and fall back into the still, where they are decomposed by the high and destructive temperature of the fire, a part going over and being condensed into light illuminating oil, almost colorless, and a part forming carbides of hydrogen or other non-condensible gases, and water, and another portion being precipitated or adhering to the sides or top of the still as solid carbonaceous matter. The residuum left in the stills as the result of such process of distillation (of which residuum the carbonaceous
763 matter last referred to forms a large part) amounts to from 3 to 10 per ct. of the oil distilled, and which sometimes exists in a tarry mass or may be reduced to a coke.

If this residuum be distilled rapidly by fire-heat in large quantities, it will produce oils from 43° gravity down to 24° or 20° Beaumé, which oils when chilled and submitted to pressure yield from eight and one-half to twelve pounds of pure paraffine per barrel of residuum, or from forty to sixty pounds per one hundred barrels of crude petroleum. Such paraffine so produced is at first a dark olive-green color, and the oil pressed out is heavy, of offensive odor, and has a characteristic blue or green color.

Then a subsequent severe and expensive chemical treatment is required to decolorize both the paraffine and oil, and to somewhat deodorize the oil. After being thus purified such oils are used as lubricants, but they are very deficient in body and contain animal or vegetable oils; which compounds assume to a great extent the blue and green tint above referred to, which in commerce is objectionable, and paraffine oils thus made do not command a ready sale for the above reasons.

My improved mode of producing paraffine and lubricating oils is a process directly the reverse of that above described. Instead of decomposing the paraffine I so carry on the distillation as to prevent such decomposition, as far as possible. In this process I distil with a comparatively low heat produced by free steam, superheated or not at pleasure, in a vacuum or a partial vacuum, with or without a fire on the outside of the still, by which means I am enabled to produce paraffine in large quantity and a superior quality of lubricating oil, both of which

are of marketable quality and in fit condition for use, requiring but little further chemical treatment.

To enable others skilled in the art to make use of my invention, I will proceed to describe the same. The crude petroleum or other hydrocarbon having first been deprived of its lighter ingredients, such as gasoline, benzine, etc., by steam distillation or otlrerwise, is admitted into a vacuum still of such construction as to permit the vapors of distillation to flow over freely or be drawn over, so that they shall not condense before leaving the still.

By a perforated pipe or in other suitable manner I admit steam
764 (common or superheated) into the body of the still, keeping up at the same time by suitable appliances a partial or nearly complete vacuum. In connection with the steam-heat a moderate fire-heat may be applied to the outside of the still in any of the ways known to the art. The process of distillation is carried on till from 38 to 48 per ct. of the crude material is driven off, which, being condensed, gives illuminating oil as a product, at which point the distillation shows a gravity of about 37° or 38° Beaumé. The contents of the still will then have a gravity of from 28° to 35° Beaumé, and contain a large percentage of paraffine. The distillate is then drawn off into another receiver.

The distillation is then continued with a comparatively low heat, so that the heavier ingredients of the oil shall not be decomposed, but being vaporized shall pass over freely or be drawn over into the condenser. The process is carried on as long as any yield of paraffine vapor can be obtained. It will be found that the condensed product becomes richer and richer in paraffine as the distillation goes on.

The condenser must be kept warm while this is going on or the paraffine will solidify and clog the apparatus.

After the distillation is finished and paraffine ceases to come over, the residuum will be found to contain very little paraffine.

The distillation is then chilled and pressed. The oil being expressed there remains paraffine of a good color, requiring very little further treatment previous to use.

Commonly remelting, rechilling, and repressing will suffice to remove all deliterious or objectionable impurities and produce a pure article of paraffine.

In this way I obtain from eight to sixteen pounds of almost chemically pure paraffine per barrel of crude petroleum, the chief reason of this larger yield being that in this process the paraffine vapors are formed a comparatively low temperature, carried over freely, and condensed without being decomposed in the still.

The oils which in the process described is expressed from the paraffine product are for lubricating purposes vastly superior to the lubricating oils produced by the distillation of the tarry residuum of the old process, or if made direct from petroleum by direct fire.

Though of less gravity, averaging 30° to 35° Beaumé, they have a much better body. They have but a slight pungent odor, which
765 is easily and almost wholly removed by a slight subsequent chemical treatment, and have hardly a trace of the blue or green tint which is a distinctive characteristic and an objectionable feature of lubricating oils made by the ordinary process. The almost entire absence of the blue and yellow tint and offensive odor renders this oil, which I have introduced in commerce as neutral topaz oil, much more valuable than the lubricating oils produced by distilling tar or petroleum or other hydrocarbon by the first process hereinbefore described and in general use.

The lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way.

By the qualities specified it is readily distinguishable by any one skilled in the art from all other lubricating oils heretofore known to the trade.

What I claim as my invention, and desire to secure by letters patent, is—

1st. The process of producing paraffine hereinbefore described, by an exhaustive distillation of the heavy oil at a comparatively low temperature, by the use of steam in a vacuum-still, with or without a fire-heat, so as to drive over the paraffine vapors undecomposed, substantially as described.

2d. The production by the process hereinbefore described of a lubricating oil, as a new article of manufacture, possessing the distinctive and distinguishing features above set forth, viz, almost entire freedom from the blue and green tints which characterize the paraffine oils of commerce.

3d. The use, in the distillation of oil, of a vacuum, or partial vacuum, in connection with steam, common or superheated, inside the still, and an auxiliary fire outside, substantially as described.

In testimony whereof I, the said Herbert W. C. Tweddle, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

Witnesses:
W. BAKEWELL,
A. S. NICHOLSON.

763 STATE OF PENNSYLVANIA,
County of Allegheny, ss:

On this eighteenth day of December, 1868, before me, the subscriber, a competent authority in and for said county and State, personally appeared the within-named Herbert W. C. Tweddle, and made solemn oath that he verily believes himself to be the original and first inventor of the improvement in the manufacture of parraffine and parraffine oils hereinbefore described, and that he does not know or believe the same was ever before known or used; and that he is a subject of the Queen of Great Britain, and not a citizen or resident of the Dominion of Canada.

A. S. NICHOLSON,
Ald. and ex-officio a Justice of the Peace.

Patent (Jan. 26, 1870) Office.

Memorandum of fee paid at U. S. Patent-Office.

Mail, $20. Inventor, H. W. C. Tweddle. Invention, manufacture of oils. Date of payment, Feb'y 1st, 1870. Fee, $30. Solicitor, Bakewell & Christy.

767 1870.

No. 99975.] [122 32.

Herbert W. C. Tweddle, of Pittsburg, county of Allegheny, State of Pennsylvania.

MANUFACTURE OF PARAFFINE AND PARAFFINE OILS.

Rec'd Jan'y 26, 1870.
Petition, " " "
Affidavit, " " "

Specification, " " "
Drawing } none required.
Model }
1 Cert. dep., $15, Jan'y 26, 1870.
Cash.
Add'l fee cert.
1 " " cash $20, February 1, 1870.
Examined Feb. 1, '70, B S. Hedrick.
2 Issue Grinnell, Feb. 3, 1870.
3 Patented Feb. 15, 1870.
Recorded vol. page.
Circular.

1870. BAKEWELL & CHRISTY,
Pittsburg, Pa.

L. L. A., Ex'd.

(Endorsement:) Improvement in the manufacture of paraffine and paraffine oils.

768 ADDITIONAL TESTIMONY FOR COMPLAINANT.

Deposition of Wm. Atwood, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, June 19, 1872.

Direct examination by Chauncey Smith, esq., counsel for complainant:

Int. 1. State what is the gravity of the petroleum which you are now distilling at the Portland Works.

Ans. From forty-three to forty-seven degrees Beaumé.

Int. 2. About what percentage of residuum do you leave in the stills when you stop the distillation?

Ans. From ten to fifteen per cent.

Int. 3. Describe the character of that residuum, and state to what extent coke is found and what its condition is in the still at the end of the distillation.

Ans. The residuum varies according to the amount of the same remaining after distillation. When fifteen per cent., or nearly that, it is a dark-brown or brownish-black color with a greenish shade, by reflected light, and comparatively free from separated carbon, and, in some cases, completely free from it, but when of less quantity it is darker in color, containing solid carbon suspended in the residuum, together with solid carbon lying upon the bottom of the still, and some coke adhering to the bottom of the still.

Int. 4. State how firmly the coke adheres to the bottom of the still when you have from twelve to fifteen per cent. residuum, and what means you find must be used to remove it.

Ans. It varies greatly in that respect. Sometimes when carbon has been separated in solid form from the residuum, none of it adheres to the iron, and is readily removed from the still by mixing sawdust or any other porous substance with it so as to absorb the liquid oil, the whole being swept up and shovelled out through the man-holes. In other cases a portion adheres so firmly to the iron that we
769 use a spade, or, as the workmen term it, a slice-bar, from two to four inches in length at the end and sharpened somewhat in the form of a cold-chisel and attached to a handle three or four feet in length. With this tool the men scrape the adhering coke from the iron,

and in a few cases where the coke adheres too firmly to be removed easily with this instrument it is removed by striking the surface of the coke with a cutting edge, similar to the hammer used by stone-cutters for cutting stone, until the coke is sufficiently cracked and loosened to be readily removed with the slice-bar.

Int. 5. And do you apply the fire heat directly to the bottom of the still, in the distillation you have referred to?

Ans. We do.

Int. 6. State whether or not, in the distillation you have referred to, you crack the oils before reaching the residuum you have described.

Ans. We do crack a varying amount, depending upon the character of the oil with which the still was charged. In some cases we crack six or seven thousand gallons so as to essentially change the color and gravity of the distillate.

Int. 7. State what percentage of the original charge of petroleum would generally be found in the still at the time it becomes necessary to crack the oil.

Ans. From thirty to forty per cent.

Int. 8. Suppose when you were carrying on the distillation in such a manner as to crack the oil you were to stop the distillation when twenty or twenty-two per cent. of residuum remained in the still, what would be the character of that residuum, and to what extent would you find coke formed so as to adhere to the bottom of the still, or so as as to be found in the condition of separated carbon?

Ans. The character of the residuum would be somewhat resembling that when fifteen per cent. was left, but of lighter color, with a greater tendency to green shades by reflected light, and if the distillation has been carefully conducted from petroleum of good quality, there would be no separated carbon, either adhering to the bottom of the still or floating in the residuum. The separated carbon when it adheres to the bottom is readily detected while the still is running, by an examination of the outside of the still bottom, peep-holes being arranged so that every part of the still bottom exposed to the greatest heat can be read-
770 ily seen, and the man who attends to the running of the still is constantly upon the watch for any indication that carbon has separated from the residuum and is adhering to the bottom of the still.

Int. 9. Do you when running your stills down to a residuum of fifteen per cent. find that coke adheres to the bottom of the still in such manner as to make it necessary to use picks or chisels to remove it, or to use any tools in such manner as to leave marks of their use upon the iron of the still?

Ans. We do not, with the exception of the hammer with which we strike the coke, and then the men are cautioned against striking the iron in any manner so as to leave any marks whatever in the still.

Int. 10. Suppose you were to push the distillation still farther, would you eventually reach a state of the residuum in which you would find coke adhering to the bottom of the still in such manner as to require such means as I indicated in my last question, for removing it? And if so, will you state at about what point you would expect to find that condition of things?

Ans. If the distillation was pushed so far as to coke any considerable proportion of the residue, the coke would adhere to the entire surface of the bottom, and would require such an amount of hammering or cutting that, with ordinary workmen, it would be practically impossible to avoid marking and injuring the still bottom. This condition of things

would occur when the distillation had proceeded so far as to leave eight per cent. or less of residuum.

Int. 11. In a former deposition you testified, I believe, that you had read a description, in a deposition of Dr. Tweddle, in this case, of a cast-iron still used by him in 1867. Have you read, or heard read, a more recent deposition of Dr. Tweddle, giving some further description of that still, and have you examined a model which has been produced and marked "Exhibit 124?"

Ans. I have heard read a more recent deposition of Dr. Tweddle's, and have examined the model referred to.

Int. 12. In that still the heat was applied by steam introduced into pipes above the bottom of the still. Suppose the distillation in that still to be pushed to such extent as to produce separated carbon, would such separated carbon adhere to the bottom of the still in the same manner as it would when heat was applied to the bottom of the still?

771 Ans. It would not.

Int. 13. In what condition would you expect to find the separated carbon, if produced in that still?

Ans. If carbon was separated from oil distilled in the still in the manner previously described of using it, that is, by drizzling the oil over the surface of the heated pipes, it would remain—nearly or quite all of it—suspended in the residuum. If any adhered to any part of the still it would be to the surface of the heated pipes; and the alternate heating and cooling of those pipes by the constant flow of steam from the necessarily somewhat irregular flow of oil, from the manner in which it was applied, the contraction and expansion of the pipes would loosen and separate such adhering carbon, and the whole or nearly the whole of the separated carbon would be found suspended in the residuum. This, however, would probably never take place unless the amount of residuum was as little as fifteen per cent., or less, of the amount of the oil being run into the still. If, however, the still was charged with such a quantity of oil as to entirely cover the pipes, distillation would take place in the same manner as when the oil was distilled by fire heat or any other source of heat applied to the external surface of the still, or to the internal surface of the pipes contained therein; the other conditions remaining the same, the character of the distillation, the character of the residue would be the same; and if any carbon was separated and adhered to any part of the still, it would be to the external surface of the pipes so heated.

Int. 14. Suppose this cast-iron still to have been used to a considerable extent without the application of any fire beneath it, but in both methods of introducing the oil, to which you have referred, and the distillation had been stopped when from twenty to twenty-two per cent. of residuum remained in the still, and such residuum was described as a heavy, dark green lubricating oil, suitable for heavy machinery or for railroad use, would you expect that carbon would have been separated in such a manner as to form coke adhering to the bottom of the still so as to require the use of picks, chisels, or any other tools to remove it?

Ans. I should not.

Int. 15. State whether or not you would regard the absence of any marks on the iron of the bottom of the still, such as would be left by the use of picks or chisels in removing a hard deposit of coke, as

772 any evidence that petroleum distilled in that still down to a residuum of twenty or twenty-two per cent. had not been cracked in the process of distillation.

Ans. I should not; for, if cracking had taken place to any extent whatever in a still thus arranged and heated, and carbon been separated to a very great extent, I cannot conceive of any means whereby it could have adhered to the bottom of the still so as to require anything more than a common shovel or scoop for removing the most of it, and the balance, if any was left, could readily be swept out when mixed with sawdust or any other porous body so as to have the whole dry enough to admit of its being swept along the surface of the iron.

Int. 16. Suppose crude petroleum of forty-three degrees gravity were introduced into that still to the amount of fifty barrels in an hour and a half, and the distillation was continued for five hours, giving seventy-four per cent. of refined oil and leaving twenty-two per cent. residuum of lubricating oil, what would be your judgment as to cracking having taken place to produce that quantity of refined oil and as to any separation of carbon in the residuum?

Ans. If the distillation of forty-three gravity oil was conducted in this still so as to obtain seventy-four per cent. of distillate and leaving twenty per cent. residuum, cracking must have taken place to a greater or less extent upon from twelve to fifteen per cent., at least, of the oil so distilled, and probably without separation of any fixed carbon in the liquid residue or adhering to the pipes, so far as they were kept covered by the liquid residue.

Int. 17. State whether or not, in distilling with fire stills, coke begins to be formed and to adhere to the bottom of the still when what is called cracking is commenced in the distillation; and if not, state how far the cracking mayo r usually does proceed before such adhering coke is found.

Ans. The separation of carbon from the liquid residue of the still does not take place when cracking commences, and not until it has progressed to a very considerable extent, or until the amount of residuum is reduced nearly or quite to fifteen per cent., and in some cases to a considerably less amount.

Int. 18. When distilling oil by cracking so as to produce illuminating oils, a point is reached when the oil begins to run of a yellow color,
773 showing that it is too heavy for illuminating oil, how much of such heavy yellow distillate can be run into the refined oil already obtained without destroying its character as refined or illuminating oil?

Ans. A very little decidedly yellow oil will destroy the color of the distillate so as to render it unfit for the ordinary use or treatment to which such distillate is submitted. Not more than two or three per cent., at most, could be used.

Int. 19. In fire distillation, with oil of 43° gravity, at about what point in the distillation would the distillate ordinarily begin to run so yellow that the conditions for cracking must be resorted to, in order to continue the production of refined oil?

Ans. Fifty-five to sixty per cent.

Int. 20. When in a fire-still you find that petroleum of the gravity I have named had yielded seventy per cent., or upwards, of refined oil, would you regard that as conclusive evidence that the cracking process had been resorted to in the latter stages of the distillation?

Ans. When seventy per cent. of distillate from 43 gravity petroleum is obtained, and that distillate is of a light color, I should consider that at least ten of the seventy per cent. had been cracked so as to essentially change the color of it.

Int. 21. Suppose that by the use of steam and vacuum, as described by Dr. Tweddle in respect to his cast-iron still, there were, as he states, less tendency to decompose the crude petroleum than there is in a fire

still, will you state whether or not you would reach the point at which the distillate would begin to be too yellow and too heavy for illuminating oil earlier or later than you would in a fire-still?

Ans. If by any means the distillation of crude petroleum is so conducted as to cause the least possible amount of change in character, or, in other words, of decomposition, the point at which the distillate would run too heavy and too high-colored for illuminuting oil would be soonest reached.

Int. 22. Then if, in such a still as the cast-iron stills used with steam and vacuum as described by Dr. Tweddle, you were told that oil of 43° gravity had been distilled so as to produce seventy-four per cent. of refined oil, leaving twenty-two per cent. of lubricating oil as a residuum, what would you conclude as to whether or not cracking had taken place to obtain that amount of refined oil?

774 Ans. I should conclude that cracking had taken place upon at least from twelve to fifteen per cent. of this oil.

Int. 23. Suppose, further than this, you were told, speaking of crude petroleum generally, that it was practicable in a still like the cast-iron still, or in any still by the use of steam and a vacuum, to obtain eighty per cent. of refined oil, what would you conclude as to the cracking of the oil being necessary to reach such a result? And what would you conclude as to the capacity of such stills to crack oils? By refined oil I mean illuminating oil.

Ans. I should conclude that, in order to obtain eighty per cent. of refined oil from crude petroleum, it would require a petroleum of the very best quality, and that petroleum would have to be cracked in a very perfect apparatus in a most thorough manner. Any apparatus that would do that would be a very perfect apparatus.

Adjourned to 20th inst. at 9.30 a. m.

JUNE 20, 1872.

Resumed.

Int. 24. State whether or not your judgment, given in the former deposition, that the cast-iron still has a large capacity for cracking oil, is changed by reason of any new facts stated by Dr. Tweddle in his recent deposition or by reason of anything which you find from examination of the model of that still which has been produced.

Ans. It is not. I find that an examination of the model of the still, and his explanation of the setting and arranging of it, confirm my previous idea in regard to it, and show that the cracking capacity would have been far too high for any ordinary distillation, had not a portion, and a very considerable one, of the surface been protected from exposure to the atmosphere. I find also that the stand-pipe left exposed to the atmosphere and situated upon the top of the dome of the still at the upper portion of a very large vapor space constitutes a still admirably adapted to cracking.

Int. 25. In your previous deposition you expressed the opinion that the wrought-iron still represented by Exhibit No. 35, considered with reference to its distilling capacity, had a less capacity for cracking than the cast-iron still. Have you re-examined this point in connection with the facts stated by Dr. Tweddle in his recent deposition in re-

775 spect to both the cast-iron and wrought-iron stills as actually constructed; and, if so, will you state what your judgment now is as to the capacity of the two stills for cracking, taking into consideration the relative distilling capacity of the two stills?

Ans. I have. I find that the wrought-iron still has a stand pipe

which I was not previously aware of, and that the surface of the still was also protected by a coating of brick-work, which I had not previously learned; but upon comparing the relative cracking capacities of the two stills, as now stated, I find that the cast-iron still has a cracking capacity nearly twice as great in proportion to its distilling capacity as the wrought-iron still.

Int. 26. Have you considered the circumstances stated by Dr. Tweddle, in reference to the fire at his works in 1870, and particularly as respects the escape of oil from the cast-iron still, and the subsequent burning of it under the still; and, if so, will you state whether or not it would have been possible, under the circumstances stated by Dr. Tweddle, that such a deposit of coke should be formed in the stand-pipe as that described by Mr. Abbott in his deposition and a sample of which he produced?

Ans. I have. I should consider it impossible to produce such a coke or carbonaceous matter, having such character and odor as that produced by Mr. Abbott as having been obtained from the stand-pipe, by any process in one distillation from residuum or crude oil in stand-pipe so far from the surface of the liquid oil contained in the still.

Int. 27. Refer to Dr. Tweddle's answer to the 72d interrogatory in his recent deposition, and state whether or not it is in accordance with your experience that the paraffine produced by fire distillation is of a dark color, and whether you are acquainted with the waxy substance spoken of by Dr. T. at the end of his answer, and, if so, what it is; and also whether, in your experience, the heavy oil vapors continue to be rich in paraffine so long as the distillation continues.

Ans. My experience regarding the color of the paraffine obtained by fire distillation from petroleum is, that it varies in color from pure white to a dark orange yellow with a greenish tint. I have been in the habit of distilling the crude oil and residuum to dryness or until nothing but coke remained in the still, and have found paraffine in every part of the distillate, after it had commenced to come over even in the
776 very last run or coating in the still—sometimes, however, associated with such tarry and viscid matters as to render it difficulty crystallizable without some other treatment. I am acquainted with the waxy substance invariably obtained at or near the completion of the distillation of petroleum or heavy oils therefrom, and have invariably found it to contain a large quantity of paraffine, so large that I have always saved it, when obtained in such quantities as to pay for handling, and worked it for the paraffine contained therein.

Int. 28. Have you observed the statements made by Dr. Tweddle regarding the amount of condensing surface which he employed in connection with his cast-iron still? If so, state whether or not the large amount of condensing surface which he describes could have been made necessary by reason of the distillation taking place in vacuo; and, if not, what circumstance mentioned by him did make or might make such amount of surface necessary?

Ans. I have. I should consider that the introduction of a large volume of steam would require a very large condensing surface to condense all the vapors from permanent gases evolved from the oil in order to diminish the work of the air-pump with which the vacuum was produced.

Int. 29. Have you had any experience in distilling Franklin oil, so called?

Ans. I have not.

Int. 30. Have you had any experience in distilling crude oils of as

heavy gravity as thirty-two degrees for the purpose of producing illuminating oil?

Ans. I have had a limited experience in distilling those heavy oils for producing illuminating oils.

Int. 31. State what percentage of such oil can be distilled off without cracking before the distillate running from the still will reach a gravity of thirty-eight degrees.

Ans. Not over from ten to twelve per cent. ordinarily.

Int. 32. Have you heard the particulars read of an experiment made by Mr. Cuddy at the Aladdin Works a few day since, in distilling twenty-five barrels of Franklin oil of a gravity of thirty-two degrees, and concerning which he states that he distilled over twenty-five per cent. as refined oil, or illuminating oil; and that, just before the
777 distillation of illuminating oil was stopped, the distillate had a gravity of thirty-eight degrees?

Ans. I have.

Int. 33. State whether or not, in your judgment, it is practicable with an oil of the gravity of thirty-two degrees to distill over, without cracking, twenty-five per cent. before the distillate falls below thirty-eight degrees?

Ans. Judging from my experience, I should say it was not.

Cross-examination by Causten Browne, esq., counsel for respondents:

Cross-int. 34. Have you examined the samples marked "Exhibit 126, 127, 128, 129," produced by Mr. Cuddy as samples of neutral topaz oil and axle or railroad oil, obtained by him in the experiments recently made at Aladdin?

Ans. I have not.

Cross-int. 35. Will you examine Exhibits 128 and 129, said to be the residual oil remaining in the still after the neutral topaz oil had been obtained in those experiments, and say whether you find in that railroad oil any separated carbon?

Ans. I do not.

Cross-int. 36. In your judgment, could an oil having the characteristics of this oil be produced as a residuum by fire distillation, with or without steam?

Ans. It could, either with or without steam.

Cross-int. 37. And without vacuum?

Ans. And without vacuum.

Cross-int. 38. Did you ever so produce it?

Ans. I have, in a small way.

Cross-int. 39. When?

Ans. The date I cannot give. I should say as early as '61 or '2.

Cross-int. 40. How much did you so produce?

Ans. A few ounces in a retort.

Cross-int. 41. Did you preserve it?

Ans. I did not.

Cross-int. 42. What stock did you work from when you produced it?

Ans. Crude petroleum obtained from Western Pennsylvania or
778 West Virginia, I am not certain which. It was the result of laboratory experiments for the production of burning oil, the residuum not being considered of any importance.

Cross-int. 43. Do you remember what percentage you got of oil like the samples in question?

Ans. The examination that I have given these samples has been only for color and freedom from solid matter, and I have obtained samples

essentially alike in those characteristics varying from twenty-five to sixty per cent.

Cross-int. 44. Do you remember how the samples which you so obtained compared with the samples numbered 128 and 129, in respect to the quality of viscidity and lubricating property or capacity?

Ans. I do not.

Cross-int. 45. In your answer to 13 direct interrogatory, you speak of the contraction and expansion of the superheated-steam pipes as tending to loosen and separate, in whole or in part, from the surface of those pipes the carbon deposited thereon; taking the construction of those pipes and their dimensions and arrangement, as shown in the model of the cast-iron still, Exhibit 124, can you state in what direction mainly the contraction and expansion you refer to would take place? You will observe that the pipes are supported at one end.

Ans. The expansion and contraction would take place in the metal part in any direction, in proportion to the extent of metal lying in that direction.

Cross-int. 46. Do you find in the samples 128 and 129 any indications that in the course of the distillation which left that oil as a residuum cracking occurred? If so, state what those indications are.

Ans. I can conceive of no indications that could be left in a residuum of that kind that cracking had taken place until it had been pushed so far as to separate solid carbon.

Cross-int. 47. Then I understand you to say that, as the samples are, you find no indications of cracking having taken place. Am I right?

Ans. You are. In the samples as they are, I find no indications to show that cracking either had or had not taken place.

Cross-int. 48. Examine the samples, called neutral topaz oil, 126 and 127, and say if you find any indications that, in the course of distillation in which that oil was produced, cracking took place; and in
779 connection with that, answer the same question as to the oil contained in Exhibit 130.

Ans. Judging from odor alone, I should think all these specimens had a small quantity of the volatile oils to which odor is mainly due, if not wholly. These oils may have been produced with or without cracking.

Cross-int. 49. Do you mean that, from the examination you have given of these three samples, you cannot tell whether in the production of them, or either of them, cracking was practised or not?

Ans. I could not. The examination was too limited to determine the essential qualities other than odor.

Cross-int. 50. If I get your meaning, the odor, such as you refer to in the last two answers, is one of the indications that cracking has been practised?

Ans. It is.

Cross-int. 51. In this respect do you observe any difference between the three samples?

Ans. 126 and 127 I find to be very similar. 130 is slightly different. Very little difference, if any, in amount; a slight difference in character.

Cross-int. 52. What is the slight difference in character to which you refer?

Ans. The characteristics of odors are so difficult to describe that I can hardly tell. Perhaps as good a description as could be given is that one compares with the other as the odor of peppermint does to that of pennyroyal.

Cross-int. 53. If there had been cracking practised in making either of the oils 126, 127, 130, would there be a blue and green tint, or what is called fluorescence, in the oils?

Ans. I do not think that is an essential characteristic of cracking.

Cross-int. 54. What do you suppose fluorescence, in the ordinary paraffine lubricating oils of commerce produced by fire distillation, to be due to?

Ans. To polarization of light.

Cross-int. 55. What is it in the oil which causes the light to be polarized?

780 Ans. It is an unstable property in the oil rather than any substance in it.

Cross-int. 56. What is that unstable property?

Ans. A property whereby in one condition the oil reflects light differently, or changes it in a different manner, from what it does in a different condition; differing only in that property.

Cross-int. 57. Do you know why it is that the ordinary paraffine lubricating oil of commerce, produced by fire distillation, has the property to which you refer?

Ans. I do not know that I do.

Cross-int. 58. Should there not be some odor in the residual oils, Nos. 128 and 129, indicating that cracking had been practised in obtaining the preceding fraction of oil Exhibits 126 and 127, if it had taken place?

Ans. I think not. No.

Cross-int. 59. Could you, in your judgment, produce by distillation under atmospheric pressure, from crude petroleum of thirty-two degrees gravity, oils having the characteristics of oils Nos. 126 and 127, without having separated carbon in the residuum, and without having fluorescence in the distillate, (assuming that the percentages of distillate and residuum were fifty-five per cent. oils Nos. 126 and 127, twenty per cent. residuum, and twenty-five per cent. of illuminating oil?)

Ans. In my judgment, I could obtain by fire distillation, from a good quality of thirty-two degrees gravity crude oil, twenty per cent. of the products in residuum of essentially the same character as those, fifty-five per cent. of products having the same character as to odor and color as Exhibits 126 and 127. As to fluorescence, I am not prepared to say whether I could or could not, as it is a point to which I have paid very little attention in practical manufacture. The balance of the distillation is crude burning oil. If the distillation was carefully conducted, there would be no separation of solid carbon.

Cross-int. 60. You say you should think all three specimens, 126, 127, and 130, had a small quantity of the more volatile oils, to which odor is mainly if not wholly due. Do you here refer to the same volatile oils to the removal of which Mr. Merrill's invention in question in this case relates?

Ans. I do.

781 Cross-int. 61. Is there any mode in use, among makers of refined oil, of restoring the whiteness which is injured by the run of a small quantity of yellow oil into the refined-oil condenser?

Ans. There is the ordinary treatment, or bleaching as some style it, which removes that color, and not in too great quantities.

Cross-int. 62. Merchantable illuminating oil varies and has always varied more or less, has it not, in this particular of freedom from yellowness?

Ans. It has. So much so, that one of the standard qualifications is

that of color, and when below certain standards it sells for an inferior price.

Cross int. 63. Has it been usual in the eastern markets to classify illuminating oils in this respect? If so, what have been the names given to the respective classes?

Ans. It has. Prime white, standard white, light straw, straw color, and a variety of other terms of similar character have been used.

Cross-int. 64. Has the same been true, substantially, so far as you know, in the Middle-State market?

As. I think that custom is very general.

Cross-int. 65. Referring to your answer to 25th direct interrogatory, will you explain how you got at the conclusion there stated, that the cast-iron still had a cracking capacity nearly twice as great, in proportion to its distilling capacity, as the wrought-iron still had?

Ans. The wrought-iron stills have heating-pipes ten feet in length, while the cast-iron still has heating-pipes of only six feet length, while the vapor space and height in the cast-iron still is the greatest, allowing condensation and cracking twice as much, in proportion to the amount being distilled, in the cast-iron still as in the wrought-iron still.

Cross-int. 66. You say, speaking of samples 126, 127, and 130, that your examination of them has been too limited to enable you to determine whether, in the production of either of them, cracking was practised. Will you state what conditions of the oil would indicate that cracking had been practised, or had not, and how those conditions can be ascertained?

Ans. It would be necessary to know the gravity and general characteristics, not only of the sample to be investigated, but also to
782 know from what it was produced, so as to ascertain whether it had been changed or not in any of those essential characteristics from what it was before distillation.

Cross-int. 67. Please explain how you conduct the distillation referred to in answer to cross-interrogatory 59, as compared with the method of ordinary fire distillation.

Ans. I mean the ordinary fire distillation with well-arranged stills, and the distillation carefully conducted.

Cross-int. 68. Do you mean that you could remove from 32° gravity crude oil twenty-five per cent. of illuminating oil and fifty-five per cent. of lubricating oil by the ordinary method of fire distillation, however carefully conducted, without separating carbon or cracking before you completed the distillation of the lubricating oil?

Ans. I do as to the separation of carbon, but not as to cracking.

Cross-int. 69. At what point in the distillation, with reference to percentage of distillate, would cracking begin in the case supposed?

Ans. As early as you commenced distilling the fifty-five per cent. of lubricating oil.

Direct examination resumed:

Int. 70. Do you mean to be understood by your last answer that in the case supposed you could obtain twenty-five per cent. of illuminating oil without cracking the oil during the distillation of that portion?

Ans. I do not, as cracking would take place to a very considerable extent before the gravity of the distillate was reduced even below forty-two degrees Beaumé.

Int. 71. Could you determine from the examination of the distillate of lubricating oils from any petroleum whether or not cracking had been produced in the production of the illuminating oils which run off before the lubricating oils?

Ans. I could not.

Int. 72. Examine the oils 131 and 132, and state whether you find separated carbon present, and how they correspond with and differ from, in other respects, Exhibits 128 and 129.

Ans. I find them both to be free from separated carbon. No. 132 is almost identical with 128 and 129 as to color. No. 131 is of a darker shade, particularly by a reflected light.

783 Cross-examination resumed:

Cross-int. 73. The substance contained in models 131 and 132 is tar, is it not?

Ans. I should say not. I should say it was residuum of petroleum oil.

Cross-int. 74. Is it what is commonly called the tar which is the residuum of petroleum distillation?

Ans. It is not what is commonly called tar with us at the East.

Cross-int. 75. Is it a known article of commerce?

Ans. Judging from its looks, I should say it was an article which was sold for lubricating purposes. We sell much cruder and darker articles for crude lubricating purposes than either of them at the works with which I am connected.

Cross-int. 76. At what price do you sell in large quantities the article of your make which is nearest to the samples referred to?

Ans. I can hardly say that we sell it in large quantities. In the quantities that we do sell it, it is at thirty cents per gallon.

Cross-int. 77. You have compared these samples with Nos. 128 and 129 as regards color and freedom from separated carbon. How do they compare in viscidity?

Ans. 132 is nearly, perhaps not quite, as viscid as 128 and 129. No. 131 is somewhat less viscid than either of the other three.

Direct examination resumed:

Int. 78. Have you any knowledge of samples 1331 and 12 other than you have derived since their production as exhibits to-day?

Ans. I have not.

WILLIAM ATWOOD.

784 *Deposition of Joshua Merrill, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, June* 21, 1872.

Direct examination by Chauncey Smith, esq., counsel for complainant:

Int. 1. State when you first had any knowledge of the letter which has been produced and marked "Exhibit No. 133."

Ans. On Saturday, the 8th day of June, 1872.

Int. 2. State whether you, before that time, had any reason to believe that your brother had ever had any communication with Dr. Tweddle, or any knowledge of his methods of manufacturing?

Ans. I had none whatever.

Int. 3. Had you been accustomed, previous to that time, to talk with your brother with reference to this suit, and if so, to what extent?

Ans. I have had very little conversation with him upon the subject, we being separated by long distance, and until the time I have just mentioned, the 8th of June, I never had more than a few moments' conversation with him on the subject.

Int. 4. Were you in 1867 acquainted with the natural lubricating oils

of West Virginia and Ohio? If so, will you state the character of those oils and their price?

Ans. I was acquainted with them. They were a heavy, viscid, dark green colored oil, suitable for lubricating heavy machinery, such as railroad axles, etc., and were very largely sold for such uses, at prices from twenty to thirty cents per gallon to the consumers—actual market price. The oils at the wells varied in price from five to ten dollars per barrel, according to quality.

Int. 5. In the circular issued by Dr. Tweddle in 1867, and marked "Exhibit No. 77," in this case, I find a statement (on page 75 of the record) that the cost of refining oil by the Dr.'s new process was fifty cents per barrel, and on the same page that the lubricating oil produced from 100,000 barrels of crude oil would be 8,000 barrels, or eight per cent., and on the preceding page I find a statement that his lubricating oil was worth, say, five dollars per barrel, and in the letter to which you have been referred I find a statement that the cost of re-
785 fining by the Dr.'s process was fifty cents per barrel, the same as in the circular, and that "the lubricating oils which result are equal to the best natural oils of Virginia and Ohio, and more than pay the cost of manufacturing, coopering, and barrelling of the refined." State whether lubricating oils of the percentage and value described in the circular would be fairly comparable in value as lubricating oils with the natural lubricating oils of Virginia and Ohio, and whether lubricating oils of such percentage in value would have paid the cost of refining, assuming it to be fifty cents per barrel.

Ans. I think the price mentioned fairly comparable with the Virginia and Ohio lubricating oils, as being about the lowest price obtainable for those products at the wells. And the value of the eight per cent. of lubricating oil would be sufficient to pay for the refining of the eighty per cent. of illuminating oil produced, as mentioned in the circular, as being fifty cents per barrel. And in addition would pay for the cost of coopering and preparing the barrels for the reception of the refined oil and for the barrelling of the same. Assuming that eighty barrels of refined oil are obtained from one hundred barrels of crude, as stated in the circular, fifty cents per barrel would amount to forty dollars cost of producing it; also assuming eight barrels of lubricating oil to be produced from one hundred barrels of crude, and assuming its value to be five dollars per barrel, it would also amount to just forty dollars. And to pay for the cost of coopering and barrelling, the lubricating oil must be sold for a price considerably above that mentioned.

Int. 6. Assuming that illuminating oils had been produced from the distillation until lubricating oils were left equal in value to the natural oils of Virginia and Ohio, and of quantity sufficient to pay the expenses of refining; state whether or not it would be necessary to crack the oils in distilling the illuminating oils in order to produce the results I have stated.

Ans. It would be absolutely necessary to crack the oils in order to produce illuminating oils merchantable in color, and of quality suitable for burning in the petroleum lamps.

Int. 7. In Exhibit No. 75, on page 370 of the record, which contains an account of the distillation of fifty barrels of crude oil of forty-three degrees gravity, I find a statement, as corrected in the following page, that seventy-four per cent. of refined oil was produced; and in
786 connection with it a statement that several hundred barrels were examined which had passed inspection as prime white, and had a fire-test of 130 degrees to 170 degrees Fahrenheit. Assuming that

the illuminating oil produced from the fifty barrels was, like the several hundred barrels examined—prime white—what amount of yellow oil could have been allowed to run into the iluminating oil distillate, after the distillation had reached the point at which it commenced turning yellow?

Ans. A very small percentage of yellow oil, three or four per cent., would be sufficient to change the color of prime white oil to a color known in the market as standard white or prime light straw to white. Those terms being used to designate the varying shades of refined oil.

Int. 8. Would the running of the yellow oil into the illuminating oil have any other effect upon the illuminating oil than to change its color?

Ans. The admixture of even small percentages of yellow or heavy oils has a tendency to injure refined oil for burning purposes, causing them to more readily char the wicks of the lamps and injure their capillary flow to the point of combustion.

Int. 9. How long after the yellow oil began to run from the still could it be allowed to flow into the previously distilled illuminating oil without rendering the latter unmerchantable under any of the classes under which refined oil is placed on the market?

Ans. An admixture of five or six per cent. of yellow oil would be sufficient to greatly reduce the market-value of the refined oil by so darkening the color as to cause its rejection for purposes of sale; and it would have to be remanufactured to make it merchantable, or subjected to a chemical treatment of acids and alkalies for the purpose of bleaching it, to which process the percentage in question, as stated in the circular, obtained from fifty barrels of crude oil, was not subjected, no acids or alkalies being used in the process described.

Int. 10. In your previous deposition you stated, in answer to interrogatory 52, (on page 663 of the record,) that it would have been impossible to have obtained the percentage of illuminating oil mentioned in the experiment referred to, viz, seventy-four per cent. from crude petroleum of forty-three degrees gravity, without cracking, to a large extent, the heavy oils. State now whether it would have been pos-
787 sible to obtain that percentage of illuminating oil, without cracking the heavy oils, to a greater or less extent, even if, at the latter stage of distillation, yellow oil had been allowed to run into the distillate as long as it could be done without rendering the latter unmerchantable, or making it necessary to receive further treatment.

Ans. If yellow oil, to the extent even of eight to ten per cent., had been allowed to run into the white oil, distilled over from the petroleum in this experiment, it would still have required a very considerable amount of cracking of heavy oil, because in distilling forty-three degrees gravity petroleum, not more than from fifty to fifty-five per cent. of oil could be obtained sufficiently white to be classed as prime white oil. At this stage of the distillation the oil coming over from the condenser would grow rapidly yellow in color, and to obtain the percentage mentioned—seventy-four per cent.—it would be necessary to crack the oil to that extent that its gravity would be very much lightened, and its color changed from yellow to white, or nearly white. If the eight or ten per cent. of yellow oil above mentioned had been allowed to flow into the white oil already produced, it would have changed its color to such a degree as to have rendered the mass so changed as to be unmerchantable, and such oil would require either redistillation or a chemical treatment of acids and alkalies in order to bleach out the color to standard white or prime white.

Adjourned to 3 o'clock p. m.

Resumed.

Int. 11. If you have any samples of illuminating oils which exhibit different degrees of fluorescence, please produce them as exhibits and state what difference in treatment, if any, there has been to which you attribute this difference in fluorescence.

Ans. I have such samples, and produce them marked "Complainant's exhibit No. 134 and 135" respectively. Exhibit No. 134 represents a sample of illuminating oil made from petroleum which is finished by fire distillation from the still as the last process; or, in other words, has been twice distilled from the petroleum by fire distillation in each instance; and it is a fair sample of the burning oil made at the works of the Downer Kerosene Oil Co., at South Boston, where I am superintendent. This sample was taken from the storehouse where 100,000
788 gallons precisely like it are stored in iron tanks. Its grade of color is that known as standard white in the market. It is almost entirely free from the property called fluorescence. It has an igniting point of about 125° F. Exhibit 135 is a sample of refined petroleum made by fire distillation by the process known as the chemical treatment process, or has been treated with sulphuric acid and alkalies as a last process, for the purpose of bleaching and deodorizing it after distillation. It has been but once distilled from the crude petroleum, and possesses in a marked degree the property known as fluorescence, or by reflected light has a deep blue shade. Its color is prime white, and has an igniting point of about 110°, and is the oil usually sold in the market as refined petroleum. I think the polarization or fluorescence is mainly due to a chemical combination with the oil of a very slight percentage of water, which combination is formed during the chemical treatment to which it is subjected. My reasons for such judgment are, that it is chemically combined with a small percentage of sulphuric acid, which can readily be disengaged by heating it in a test tube or glass retort to its boiling point, when sulphurous gases will be liberated sufficiently to be plainly observed by smelling of the vapor at the tail pipe of the retort, and also by its discoloring litmus paper when held slightly moistened in the vapor as it escapes from the retort. This is true of all illuminating oils finished by an acid treatment as a last process. A complete distillation of the oil Exhibit 135 in the presence of a small quantity of caustic alkali in the retort during distillation destroys the fluorescent property almost entirely, and makes an oil like Exhibit 134.

Int. 12. If you have ever observed the fluorescence exhibited by illuminating oils which you have distilled by aid of a vacuum, state how it compares with oils like Exhibit 134, finished by fire distillation.

Ans. I have observed illuminating oils made by vacuum distillation, and they compare very nearly with the oil Exhibit 134 as to fluorescence without having received any chemical treatment. But a treatment of acids and alkalies as a last process develops to a considerable degree a fluorescent property in the oil, and also does in Exhibit 134.

Int. 13. Is the degree of fluorescence of illuminating oil dependent in any way upon the extent to which cracking has been carried in the production of the oil?

Ans. In my judgment, it is not in the slightest degree.

789 Int. 14 Two samples of residuum oil were yesterday shown to Mr. Atwood, marked 131 and 132; state, if you know, what these oils are, respectively.

Ans. Exhibit 131 represents a sample of residuum made at the Imperial Oil Co.'s Refinery, at Oil City, Penn., and which was purchased of

that company to the extent of 3,500 bbls. by the Downer Kerosene Oil Co., of Boston. The purchase was made of John Gracie, one of the proprietors of that establishment. He stated it to be (objected to) a ten per cent. residuum of ordinary Pennsylvania crude petroleum. It is a residuum of fire distillation where the cracking process had been practised, making all the crude petroleum, after the removal of the naphtha, into illuminating oil by the process known as cracking. This sample contains no separated carbon, but I have no doubt considerable quantities of coke were found which adhered to the bottom of the still when this residuum was produced; had it ever contained any separated carbon it has settled out of it by rest in a tank into which it is pumped from the still. When this residuum is subjected to distillation by fire-heat it yields about eighty-five per cent. of its volume of heavy oil, rich in paraffine, yielding nearly if not quite twenty pounds of scale paraffine to each barrel of forty gallons of residuum, or one-half pound to the gallon; and from this residuum the deodorized lubricating oil is produced. The price paid for this residuum was two dollars and fifty cents per barrel, of forty-three gallons bulk, at the works in Oil City. It is an unusually good quality of residuum, and would answer a good purpose as a lubricator for heavy machinery, like railroad-axles, etc., either alone or in combination with other oils. Exhibit 132 is a residuum of petroleum representing about thirty per cent. of the original crude petroleum from which it is made. It is produced in the following way: I first place the crude petroleum in a distilling vessel, and by the aid of steam distil over the naphthas until the gravity reaches sixty degrees Beaumé running from the condenser The oil is then pumped into another distilling vessel under which is a furnace, and steam-pipes are provided for introducing steam into the still. A fire is built under the still, and when the oil begins to distil over at the condenser, steam is turned into the still and continues to flow in until the oil distilling over from the condenser has a gravity of from thirty-seven degrees to thirty-
eight degrees Beaumé. The fire is then withdrawn, and after the
790 lapse of half an hour the steam is shut off, and the oil remaining in the still allowed to cool off, when it is pumped out of the still into a store-tank, and represents about thirty per cent. of crude petroleum of from forty-three degrees to forty-five degrees Beaumé, and is then the oil shown by Exhibit 132, which was taken from the store-tank referred to. It is very oily in body, of a dark-green color, slight odor, and is a valuable oil for lubricating machinery, and the Downer Kerosene Oil Co. have sold and do sell it largely for this purpose. The price obtained in cargo lots is now thirty cents per gallon, gold. Until the present year we sold it for thirty-five cents per gallon, currency, which price includes the package in which it is contained, or about twelve dollars, gold, per barrel of forty gallons. We have recently sold 1,000 barrels at this price for shipment to Europe. And for our retail sales in lots of from five barrels upwards we obtain thirty-five cents per gallon, currency.

Int. 15. State whether or not any cracking takes place in the process you have described in distilling off the illuminating oils, and whether any coke is deposited or any separated carbon produced. And state also what would be the character of the residuum if the distillation were carried on until twenty per cent., or thereabouts, only remained, and whether cracking would then be necessary if the whole distillate was obtained as illuminating oil, and whether separated carbon or coke would then be produced.

Ans. Cracking does take place in the process I have described, but

to a less degree than when performing the distillation by fire alone. The steam used during the distillation is a powerful preventive of cracking, and brings the oil vapors over at a much lower temperature than is the case when fire distillation alone is resorted to. There is not the slightest trace of separated carbon in the residuum, neither is there the slightest trace of coke adhering to the bottoms or sides of the distilling vessels. I have distilled oil in this manner for weeks consecutively with the same apparatus, at the end of which time the still was as clean and free from coke as the first day it was used. If the distillation was allowed to proceed until only twenty per cent. was left in the distilling vessel, the residuum would be more unctuous and oily in body, and no coke whatever or separated carbon would result from such distillation. If the whole distillate was obtained as illuminating oil, and leaving twenty per cent. residuum in the still, cracking must in-
791 evitably take place, or at least thirty per cent. of the oil distilled over, and the residuum would be darker in color with less shade of green than Exhibit 132, but would not contain separated carbon, nor would coke be deposited upon the bottom of the distilling vessel.

Adjourned to 10.30 a. m., 22d.

JUNE 22, 1872.

Resumed:

Int. 16. In the ordinary fire distillation of petroleum, does the deposition of coke or the separation of carbon commence when the cracking process, so called, commences? And, if not, state at what stage, after cracking commences, these results are exhibited.

Ans. The separation of carbon or the deposition of coke does not take place in the distillation of petroleum by fire, where cracking is practised, until the distillation has progressed so far that only from ten to twelve per cent. of residuum is left in the distilling vessel. But the residuum in the still grows richer and richer in carbon as the distillation proceeds, and when only from ten to twelve per cent. is left in the still, it is incapable of holding the carbon in solution, and gradually deposits it upon the bottom of the still in the form of coke, and slight traces of separated carbon may be observed in the residuum in the form of minute particles. After considerable rest these minute particles of separated carbon will settle entirely out of the residuum, leaving it wholly free from such particles.

Int. 17. If two stills were to be charged with the same petroleum, and one of them was to be so constructed or managed that less decomposition of the oil should take place before the point for cracking was reached than in the other, in which of them would you first reach the point at which the distillate would run so yellow and so heavy that it would be unfit for illuminating oil; and in which, if cracking was to be resorted to in both, would you have to crack the largest amount, supposing the distillation to be carried to the same percentage of residuum in each case?

Ans. In the one in which the least decomposition was allowed to take place you would soonest reach the point when cracking must take place to make the oil sufficiently good in color for illuminating oil. Precisely the same amount of cracking would have to be resorted to in either still in order to make the oil of sufficiently good color for illumi-
792 nating oil. But where no precautions were taken to prevent the cracking of the oil, much more thin oil, suitable for illuminating, of good color, would be produced.

Int. 18. Are you acquainted with the Franklin oil, so called, and have you been accustomed to distil it?

Ans. I am acquainted with the Franklin oil, and am accustomed to distil it.

Int. 19. With this oil of thirty-two degrees gravity, what percentage can be distilled off, by ordinary fire distillation, before the distillate was at a gravity of thirty-eight degrees?

Ans. About fifteen per cent., when distilling by fire alone, will distil over before the gravity reaches thirty-eight degrees Beaumé.

Int. 20. If with the aid of steam and a vacuum, or with these agents alone, less decomposition takes place than when distilling by fire alone, could you distil off more or less than fifteen per cent. before the distillate will be at a gravity of thirty-eight degrees?

Ans. You would distil off much less with these modes of distillation. When distilling by steam and vacuum, nine per cent. of oil will be distilled over only, before the gravity reaches thirty-eight degrees Beaumé. When distilling by fire and steam without vacuum, about ten per cent. will distil over at this degree of gravity. Any percentage in excess of nine or ten per cent. referred to, can only be obtained by cracking the oil to a considerable extent.

Int. 21. Did you hear the testimony, and have you since read it, of Mr. Cuddy, in Pittsburg, in respect to the distillation of twenty-five barrels of Franklin oil at the Aladdin Works on the sixth day of June current, and also that of Dr. Tweddle in respect to the same distillation?

Ans. I did hear the testimony describing the experiment performed on that day, and have since read the depositions of Mr. Cuddy and Dr. Tweddle on that subject.

Int. 22. Mr. Cuddy states that in respect to this first distillation of that oil by superheated steam and vaccum, twenty-five per cent. was distilled over as illuminating oil, and that the gravity of this distillate just before this distillation was stopped was thirty-eight degrees. State whether or not cracking must have taken place to obtain these results.

Ans. Cracking must inevitably have taken place in at least
793 fifteen per cent. of the product, viz, twenty-five per cent., for not more than ten per cent. could be obtained from thirty-two degrees Franklin oil before the gravity would reach thirty-eight degrees Beaumé, unless cracking had taken place.

Int. 23. Mr. Cuddy states that twenty-five per cent. of illuminating oil was distilled over in three hours, and that fifty-five per cent. of neutral topaz was afterward distilled over, in another still, in two and a half hours. State the comparative rate of distillation per hour in these two cases, and if the rate of distillation has any bearing upon the question of the cracking of the illuminating oil, state what it is.

Ans. The rate at which the burning oil was distilled was about two barrels per hour, as twenty-five per cent. of twenty-five barrels is a trifle more than six barrels' total product of burning oil obtained, and three hours *was* consumed in distilling it. Fifty-five per cent. of twenty-five barrels, obtained as lubricating oil, is about thirteen and one-half barrels. As two and one-half hours were consumed in obtaining this amount of lubricating oil, it was distilled at the rate of five and a half barrels per hour, or two and a half times more rapidly than the burning oil was distilled. I think this would, in a great measure, account for the cracking of the oil, because, in cracking, the element of time or rapidity of the distillation is very important. Rapid distillation always prevents, to a considerable degree, the cracking or decomposing of the oil under-

going distillation—the practice being to always slow down the distillation to a great extent when cracking is desired.

Int. 24. In your judgment, could twenty-five per cent. of that oil have been run off, without the gravity going below thirty-eight degrees, if the distillation of the illuminating oil had proceeded as rapidly as that of the neutral topaz, all other conditions being the same?

Ans. I think it could not.

Int. 25. If you have, since the 6th June, made a distillation of Franklin oil for the purpose of ascertaining what percentage of oil could be distilled over before reaching a gravity of thirty-eight degrees with the aid of superheated steam and vacuum, will you state the particulars of the trial and of the apparatus employed, and with whose aid the trial was conducted?

Ans. I made a distillation of Franklin oil in a vacuum-still on the
17th day of June, Dr. S. Dana Hayes being present and assisting
794 the distillation, he saving fractions of the distillation from the
commencement to the completion, which are in his possession. The still was the same apparatus to which I have referred in a former deposition, so far modified as to entirely encase the still in brick-work laid in cement, and the cover of the still being covered with plaster two inches in thickness. I also erected a superheating furnace situated as close as possible to the still—not more than three feet distant—containing fifty feet of one-and-one-half-inch wrought-iron pipe, under which w*as* placed two furnaces for the purpose of superheating the steam by the aid of direct fires. I also placed a vacuum-gauge upon the still, and one upon the receiver connected with the condenser. I built a fire under the superheating pipes about one and one-half hours before attempting to distil the oil, in order to thoroughly superheat the steam. I put one hundred gallons of thirty-two degrees Franklin oil in the still. I built a small fire under the still and turned superheated steam through the coil in the still, which coil is twenty-five feet in length of two-inch wrought-iron pipe. I started the vacuum-pump, creating a vacuum in the still of about twenty inches of mercury, and when the still began to run oil at the condenser, carefully saved the fractions of three gallons each as they were pumped out by the vacuum-pump, taking their gravity at the end of each three gallons distilled over. When nine gallons had been distilled over, representing nine per cent. of the crude oil put in the still, the gravity had reached thirty-eight degrees Beaumé, the oil constantly growing heavier as the distillation proceeded; and when twenty-five per cent. was distilled over, the gravity of the distillate at that fraction was thirty-three and one-half degrees Beaumé, I believe. Superheated steam was also introduced directly into the oil through perforated pipes during the entire distillation. Twenty-one gallons of residuum was left in the distilling apparatus, representing twenty-one per cent. of the original crude oil.

Int. 26. What was the character of this residuum, and how did it compare with the samples produced by Mr. Cuddy as the residuum of his experiment?

Ans. It was a dark-green colored oil, very viscid and oily in body, and was essentially the same article as the residuum produced by Mr.
Cuddy.

975 Int. 27. What product did you obtain between the illuminating oil and this residuum?

Ans. There was about twenty-five gallons distilled over between the gravities of thirty-four degrees and thirty-one and one-half degrees Beaumé, which was all put together in a vessel, and ten gallons of it was

treated with acid and alkali to produce neutral topaz oil. About twenty-seven gallons ran off heavier than thirty-one and one-half Beaumé, but was so dark in color as to be unfit for treatment to make neutral topaz. The sample treated for neutral topaz had a gravity of thirty-two and one-half Beaumé at sixty degrees F. The color and odor of the treated topaz was essentially like the topaz produced by Mr. Cuddy and put in as exhibits, and is of precisely of the same gravity Beaumé.

Int. 28. If the twenty-seven gallons which you say was too heavy and dark for neutral topaz had been somewhat more decomposed or broken up in the process of distillation, could it have been made into neutral topaz?

Ans. If it had been decomposed sufficiently to have formed thin and offensive oils associated with it, it could not have been made into neutral topaz, although its color might have been improved. It would have been impossible by any treatment to have deodorized it. Nor do I believe it practicable in one distillation of Franklin oil of thirty-two gravity to make all the distillate of heavy oil heavier than thirty-one and one-half Beaumé of sufficiently good color to be merchantable in the market as neutral topaz oil.

Int. 29. Will you state what difference, if any, you found between the vacuum at the receiver and that at the still itself?

Ans. A very slight difference, not more than half an inch of mercury; the gauge on the still indicating a more perfect vacuum than on the receiver.

Int. 30. You heard Dr. Tweddle's account of the escape of oil from the cast-iron still at the Eclipse Refinery at the time of the fire, and of its burning under the still, while some portion, as he thinks, remained in the still. Will you state whether or not, in your judgment, the deposit of coke which you observed in the stand-pipe of the cast-iron still could have been produced by the fire described by Dr. Tweddle, and the distillation within the still of some portion of the heavy oil spoken of by Dr. Tweddle?

796 Ans. I have heard the Dr.'s statement, and have read it, and I believe the deposition of coke in the stand-pipe could not have been caused by the fire as he describes. He states that the still contained about forty barrels of a heavy residuum oil, which from the breakage of pipes was allowed to escape into the cavity beneath the still. I find from accurate measurements of the capacity of the cavity under the still, as given in the model which he has put in as an exhibit, that not more than five or six barrels could have remained in the still after the cavity was filled. He states also that the cavity was closed so that it had no outlet or communication with the atmosphere outside, and it would have been impossible for the oil to burn or create heat underneath the still, as no atmospheric air could get to it in sufficient quantities to support combustion. He states that a strong fire surrounded the still on the outside for forty-eight hours nearly, but the still was entirely encased in brick-work to the very bottom of the stand-pipe, and it would have been exceedingly difficult if not impossible to convey heat enough through the bricks to raise in vapor the small quantity of oil left in the still. But even if this had been done, and the five or six barrels remaining in the still had all been vaporized, the quantity of vapor passing through the stand-pipe exposed to the heat as he describes would have been far too small to account for the quantity of coke deposited on the inside of the stand-pipe. In my opinion that coke was the result of deposition from many distillations where considerable cracking has taken place.

Int. 31. In his answer to the 72d interrogatory in his recent deposition, Dr. Tweddle says that "even in fire distillation of petroleum tar the paraffine products are entirely over before distillation is fully completed; a substance resembling somewhat paranap'thaline seems to have been substituted." What has your experience been as to the production of paraffine towards the end of the distillation of petroleum, or petroleum tar, and what is the substance to which the doctor refers at the close of his answer, and what is the color of the paraffine which is obtained by fire distillation of petroleum or petroleum tar?

Ans. My experience has been, in distilling petroleum, that the distillate grows richer and richer in paraffine as the distillation proceeds, until very near the end of the distillation; usually from 1,000 gallons still there will be from fifteen to twenty gallons of the very last run of
797 the still that is dark in color and which distillers of petroleum call cokings. This oil contains large percentages of paraffine in semiformed condition, or as amorphous paraffine. When this last portion is redistilled the paraffine becomes fully developed in crystallizable form, and is of good quality and as large in quantity as any other portion of the distillate. In distilling petroleum tar where ten barrels of tar represent one hundred barrels of crude petroleum, at the latter end of the distillation the temperature of the still has to be raised so high that more of the amorphous paraffine in quantity is produced. The last twenty or thirty gallons run from six hundred gallons of tar is waxy in structure and yellowish in color, and in color only does it resemble paranaphthaline, which is a yellow, crystallizable body obtained from the distillation of coal tar from the gas works. The yellow substance distilled from the petroleum tar contains no crystals; but when it is redistilled, perfectly-formed crystals of paraffine and a good quality of heavy lubricating oil is obtained from it. The color of the paraffine obtained from the distillation of petroleum by fire heat is for a large portion of the distillation of the heavy oil, white, or nearly white, in color. The paraffine obtained from distilling the tar is more yellow in color and usually requires one additional distillation of the heavy oil only to make it perfectly white.

Int. 32. In his answer to the 73d interrogatory in his recent deposition, Dr. Tweddle states that the red heat of the superheated-steam pipe through which steam passes to the still is not a correct indication of the heat of the steam passing into the still; and at the latter end of his answer he goes on to show that a red-hot pipe is not a correct indication of the temperature of superheated steam passing through it, because when a large quantity of steam is passed through the pipes it will not be heated to the same degree as when a small quantity is passed through. But in his answer to the 193d cross-interrogatory of his first deposition, on page 327 of the printed record, he refers to the red heat of the pipes in answer to an inquiry as to the temperature of the steam; and in answer to the 195th cross-interrogatory, on the same page, he states that the pipes were heated to a red heat at the point where the steam entered the still by the steam passing through. Assuming this to be so, that the pipes are heated to a red heat by the steam at that point, is that any indication that the steam itself was at least at the same
798 temperature, and that it would, as previously stated by you, on page 667 of the record, make the temperature of the still much above the temperature necessary to distil the petroleum?

Ans. It is certainly an indication that the steam must have been heated to a temperature at least as hot as iron visibly red, and that tem-

perature is hotter than that required to distil even the heaviest portions of petroleum.

Int. 33. In his answer to the 74th interrogatory of his recent deposition, when referring to your description of a residuum oil obtained in a vacuum still which you had described, where the oil was about run down to eighteen or twenty gallons from one hundred and forty-eight, and was so very viscid that it was difficult to measure it with accuracy, and was very dark green in color, almost black, and had but little smell, Dr. Tweddle says that had you run down the same oil in a fire-heated still under atmospheric pressure, with the same steam-appliances, he would have had black tar and separated carbon, the tar would not have possessed anything like the same body or viscidity, nor would he have obtained the same percentage of heavy oil from thirty-seven gravity down to twenty-eight, namely, thirty-five gallons. Will you state whether or not you did, at the time of making the experiments referred to, among them make one under precisely the conditions stated by the Dr., viz, with the same oil in a fire-still, under atmospheric pressure, with the same steam appliance? If so, will you state what result you obtained as residuum, and will you produce a sample of the residuum?

Ans. I did make an experiment at about the time the experiment was made, referred to in my deposition; the experiment was made September 13, 1870. In that experiment I distilled one hundred and forty-eight gallons of crude petroleum under atmospheric pressure, by fire and steam, leaving in the still, after the distillation was completed, nineteen and three-fourths gallons of residuum, equalling thirteen and $\frac{34}{100}$ per cent. of the original crude. I here produce a sample as exhibit in this case, marked "Complainant's exhibit No. 136." This residuum is of a dark green color, nearly black, very viscid in body, and is a first-rate lubricating oil. There was no sign of coke in the distilling apparatus, nor any signs of separated carbon in the residuum. The quantity of
799 heavy oil obtained, heavier than thirty-seven degrees Beaumé, was forty gallons, although fifteen gallons of this was too much colored to be used as lubricating oil, and would require redistillation to lighten its color. The crude petroleum was precisely the same in both of the experiments referred to in this question and answer.

Int. 34. Will you state whether or not any of the additional facts given by Dr. Tweddle, in his recent deposition in relation to his cast-iron still, give you any reason to change the opinion you had previously expressed, that that still had a large capacity for cracking oil?

Ans. None of the statements made by Dr. Tweddle have changed my opinion in the least in regard to that still being of large cracking capacity.

Adjourned to 10 a. m., Monday, 24, 1872.

JUNE 24, 1872.

Resumed.

Int. 35. Can the character of a residuum be determined by simply knowing the percentage of illuminating oil which has been distilled off, without knowing the percentage of naphtha which has been distilled off, or of the residuum left?

Ans. It cannot; for the reason that the percentages of naphtha vary largely, as also the percentages of illuminating oils which are obtained from petroleum.

Int. 36. When does the residuum of petroleum distillation assume the character which manufacturers would call tar?

Ans. When the process is carried so far that coke is liberally deposited in the bottom of the distilling vessel.

Int. 37. Why is a residuum of ten per cent. or less not so valuable as a residuum of twenty per cent. or over?

Ans. Because in a ten per cent. residuum the carbon is in a more concentrated form; and valuable products in the form of heavy oils have been distilled over, or the valuable heavy oils may have been cracked up into illuminating oils. The twenty per cent. or more of residuum would contain all those products and be entirely free from tarry matters, and be much more valuable for lubricating purposes.

Cross-examination by Causten Browne, esq., counsel for respondents:

Cross-int. 38. Did you ever observe illuminating oil as it flowed from the condenser, to see whether it showed any fluorescence? I speak, of course, of distillation under atmospheric pressure.

800 Ans. I have observed it flowing from the condenser under the conditions named; and when distilled plain, or without the presence of caustic alkalies in the still, and when steam is not used during distillation, it has marked fluorescence.

Cross-int. 39. Did you ever observe illuminating oil flowing from the condenser, while distilling under atmospheric pressure, showing no fluorescence?

Ans. I never did entirely free from fluorescence, but so much so as to be commercially free from it I have daily observed.

Cross-int. 40. State exactly under what conditions the distillation was proceeding when you observed this.

Ans. Under those daily practised at the works where I am superintendent, which consist in distilling the petroleum oils under atmospheric pressure by fire heat with or without steam in the still during distillation, but always in the presence of caustic alkali introduced into the distilling vessel.

Cross-int. 41. If I understand you, then, the use or non-use of steam in the distillation is not a matter upon which the fluorescence depends, but it depends upon the presence or absence of the caustic alkali in the still. Is that so?

Ans. Where caustic alkali is used, I do not think the use of steam essential in preventing fluorescence; and where it is not used in the still, the steam serves, to a very decided extent, to prevent the fluorescent appearance of the oil during and after distillation. The reason of this action is, in my opinion, that steam unites with and washes from the oil the sulphur compounds which are associated with the petroleum in its crude state, and prevents to a great degree the formation of sulphur compound with the oil when subjected to distillation.

Cross-int. 42. Are these same things true of the heavier distillates, such as paraffine lubricating oil?

Ans. They are.

Cross-int. 43. How long has it been customary to use caustic alkali in the still?

Ans. Since the very earliest days of the coal-oil business.

Cross-int. 44. How long is it since paraffine lubricating oil has been produced commercially free from fluorescence?

Ans. Since 1856 in my own manufacture; the products at that
801 time being made from Albert coal and from Boghead coal, which products, as I stated in a former deposition, were almost entirely free from fluorescent properties.

Cross-int. 45. I speak of distillation from petroleum or petroleum tar. How long has paraffine lubricating oil been produced from these, having, commercially, no fluorescence?

Ans. Since 1860 we have worked petroleum, and from that time to the present they have been and are commercially free from fluorescence, like the exhibits representing those manufactures put in in this case.

Cross-int. 46. What do you mean by "commercially free from fluorescence" when you apply that term to the paraffine lubricating oil made by your company prior to '67?

Ans. I mean that in the sale of those oils, either to the consumers or to dealers in oils, we had or have no objection made to the oil on account of fluorescence, since 1860.

Cross-int. 47. As made prior to '67, in what proportions could your paraffine lubricating oil be mixed with sperm, without showing by the fluorescence the presence of paraffine oil?

Ans. I do not know the precise proportions that could be mixed without detection, but I believe that not more than twenty or twenty-five per cent. could be added to sperm oil without, under certain favorable conditions of exposure to light, being readily detected, as all paraffine oil made by any process that I have ever seen has some fluorescence by reflected light.

Cross-int. 48. Was your paraffine lubricating oil made prior to '67 any more free from fluorescence than a good average of paraffine lubricating oil of other parties' manufacture at that time?

Ans. I believe it was much freer from fluorescence than any paraffine oil in the market, with the exception of the Portland Company's. We manufactured under the same processes, and the oils were always finished by distillation as a last process, and not by chemical treatment, and were all at least twice distilled, and always in the presence of alkali in the still; whilst the practice of ordinary paraffine-oil makers was, on a large portion of their oil, to distil but once from the residuum and finish the oil by a treatment of acids and alkalies, and on a portion of their manufacture to double the still without alkalies in the still, which was also finished by acid and alkali treatment as a last process.

802 The oil first described as but once distilled from the residuum was usually very fluorescent, both blue and green colors being very apparent. The double-distilled oil had less of the green shade, but a good deal of the blue.

Cross-int. 49. When cracking is practised in the production of illuminating oil, what effect, if any, is produced in the paraffine lubricating oil, which is the next distillate?

Ans. If the cracking is carried on to a considerable extent, and no lubricating oil is distilled as the next distillate, until not more than ten or twelve per cent. of residuum is left in the still, the lubricating oil that would result from the distillation of that residuum would be precisely the same as though the still were filled up with the ten per cent. residuum, and distillation performed upon it. It would be a good quality of lubricating stock. To make a first-class article it would require to be treated with chemicals and subjected to redistillation. If cracking was not carried on so extensively, and a residuum of twenty or twenty-five per cent were left in the still after the cracking had stopped, the lubricating oil resulting from the distillation of that residuum would be much better in quality, and if carefully distilled a considerable portion might be finished into lubricating oil by the chemical-treatment process, and a considerable portion towards the last of the distillation would require to be redistilled as in the first instance described.

Cross-int. 50. What I wish to know is, what characteristics of a paraffine lubricating oil show, in your opinion, that cracking took place in the distillation either of that oil or of the preceding illuminating oil.

Ans. I do not think any appearance or peculiar characteristics of a lubricating oil would indicate whether cracking had been resorted to, to produce illuminating oil, but if the heavy oil distillate was light in gravity and somewhat thin in body, and the paraffine was in a very crystalline form when cooled, I should consider that evidence that the heavy oil had been partially cracked by being distilled.

Cross-int. 51. If cracking had been resorted to in getting either the illuminating oil or the paraffine oil, would there be any bad odors resulting which would show themselves in the paraffine oil?

Ans. The paraffine oil would have a bad smell, as do all the distillates of petroleum, whether cracking had been practised or not.

Cross-int. 52. Would it have the bad odors which you described
803 in your patent as the characteristic odors of the paraffine lubricating oils, to the removal of which your invention relates?

Ans. If they had been cracked so as to form the thin and offensive oils there referred to, giving the characteristic odors, they would have that smell and also another bad smell known as the still smell, the latter being easily removable by chemical treatment.

Cross-int. 53. It is then a question of the degree to which cracking has been practised in obtaining a given percentage of paraffine lubricating oil, whether such oil shows more or less or any appreciable amount of the characteristic odors of thin and offensive oils just mentioned. Is that so?

Ans. I think it is dependent upon the amount of decomposition of the paraffine oil while undergoing distillation, thereby forming those thin oils the removal of which, or the absence of which, leaves an oil commercially deodorized.

Cross-int. 54. Does, or does not, the degree in which those thin oils are formed depend upon the degree in which cracking has been practised to obtain the oil in which they are present?

Ans. It does depend upon the degree in which or extent to which heavy oil has been cracked while distilling the paraffine oil.

JOSHUA MERRILL.

Adjourned to 25th inst. at 10 a m.

Deposition of H. W. C. Tweddle, taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, June 21, 1872.

Direct examination by Chauncey Smith, esq., counsel for complainant:

Int. 1. Have you been previously examined on behalf of respondents in this case?

Ans. I have.

Int. 2. Will you look at a letter which I will now hand you, and state whether you wrote it?

Ans. I wrote that letter.

804 Int. 3. State whether or not it was written at the time it bears date.

Ans. I presume it was.

(Said letter is offered as an exhibit by counsel for complainant, and is marked "Complainant's Exhibit No. 33, N. A. P., ex'r.")

Int. 4. Do you wish to make any statement or explanation in relation to the circumstances under which the letter was written, or respecting its contents?

(Objected to.)

Ans. When I wrote that letter I think I must have been under the impression that I was addressing it to Mr. Joshua Merrill, not to S. M. Merrill. The only Merrills whom I knew were Mr. Joshua Merrill and a brother, who is much stouter than Mr. Joshua Merrill, whom I saw in Boston about the year '64 or '5.

Int. 5. Do you recollect what the accident was to which you referred in the first part of the letter, and how you became acquainted with it?

Ans. I do not.

Counsel for respondent declines to cross-examine.

HERBERT W. C. TWEDDLE.

Complainant's Exhibit No. 133.—*N. A. P., ex'r.*

ECLIPSE PETROLEUM REFINERY,
Pittsburgh, Pa., Aug't 20th, '67.

S. M. MERRILL, Esq.:

DEAR SIR: I have just noticed the serious and unfortunate accident which has lately befallen you, and beg to assure you of my sincere sympathy. The truly dangerous character of the business in which we have both so long been mutually engaged has been recognized by me so frequently during the past few years, in the many disastrous fires and explosions which have occurred in refineries here, that when I sold out my interest in the "Standard" I determined either to carry out long-cherished plans—to divest the business of all its hazards and dangers, or retire from it altogether—on the ground that sooner or later, in my constant attrition with its dangers, I would suffer the inevitable fate of almost all who are constantly engaged in it; and life, health, and its attendant pleasure I hold at a much higher value than all the petroleum ever produced.

In my new works I think that the oil-refining business is divested of all the attendant dangers of the old process. The crude oil is run into the apparatus and is returned to the refined-oil tank finished oil, inside ten minutes without being exposed, without using any other agent than steam; acid, alkali, or any other chemical treatment being entirely dispensed with, and the oil produced is superior to any that has ever been made by the old process—all danger, dirt, filth, or odors are avoided. When my apparatus is completed, one man and a boy can make a thousand barrels daily easier than they could produce ten the old way.

Your long practical experience I feel sure will enable you to appreciate the many advantages of this process; aside from its great economy, the lubricating oils which result are equal to the best natural oils of Virginia and Ohio, and more than pay the cost of manufacturing and coopering and bar'elling of the refined; in other words, I can produce the refined oil at 50 cents per brl. against $1.50 to $1.80 by the old process.

Trusting that some day I may have the pleasure of exhibiting the operation of my apparatus to you, and trusting that your injuries may not be so serious as the newspaper paragraph would lead me to believe, I remain, with assurances of esteem to Mr. Downer and your brother,

Yours, very truly,

HERBERT W. C. TWEDDLE.

(Endorsement:) Eclipse Petroleum Refinery, August 20, 1867.

Deposition of John M. Merrill, taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, June 21, 1872.

Direct examination by Chauncey Smith, esq., counsel for complainant:

Int. 1. State your name, age, residence, and occupation.

Ans. John M. Merrill; age, 52; residence, Corry, Penn. I am superintendent of an oil-refinery.

806 Int. 2. Where did you reside in 1867, and what was your occupation then?

Ans. I resided in Corry, Penn.; my occupation was superintendent of an oil-refinery—Downer's oil-refinery.

Int. 3. Look at letter, marked "Exhibit No. 133," and state whether or not you received that letter about the time it bears date, and in what way, and at what place.

Ans. I did receive the letter shown me, at about the time of the date of the letter, in Corry, Penn., by mail.

Int. 4. The letter refers to an accident which had befallen you; what accident was that?

Ans. It was a personal injury, received by burns. There was an explosion of oil-vapor on the removal of a man-plate from a two-hundred-barrel still; in which explosion I was severely burned about the face and hands, which disabled me for several weeks.

Int. 5. Were you at that time acquainted with Dr. Tweddle, of Pittsburg, or have you since been personally acquainted with him?

Ans. I was not, and have not been since.

Int. 6. And did you reply to this letter, or have you ever had any other correspondence by letter with Dr. Tweddle?

Ans. I did not. I have never had any other correspondence with him.

Int. 7. Are you brother of Joshua Merrill, complainant in this case?

Ans. I am.

Int. 8. When did you first inform him that you had received this letter, and how came you then to do so?

(Objected to.)

Ans. I informed him of the receipt of the letter about a fortnight since. He was then at Corry, and in conversation with him in regard to some circulars which Mr. Tweddle had issued, in which he made statements in regard to the per cent. of illuminating oil that could be produced by his process of manufacture, the thought suddenly occurred to me (a fact which I had almost forgotten) that I had received a letter from Mr. Tweddle expressing kindly sympathy at my misfortune, and also referring to his new invention, in which he makes some statements in reference to the manufacture of illuminating oils by his peculiar

807 process. I mentioned the fact to my brother. I carefully looked over my own letters, supposing I might find it among them; but I presently recollected of having handed the letter to Mr. Smith, the manager of the works; and on looking in the files for the month of August, 1867, the letter was found, and my brother took possession of it.

Int. 9. State whether or not this conversation with your brother, to which you last referred, took place after his return from a visit to Pittsburg.

Ans. It did.

Counsel for respondents decline to cross-examine.

JOHN M. MERRILL.

Deposition of S. Dana Hayes, (recalled,) taken, subscribed, and sworn to before N. Austin Parks, esq., notary public, examiner, June 20, 1872.

Direct examination by Chauncey Smith, esq., counsel for complainant:

Int. 1. What do you understand the term "cracking" to apply to as used by the refiners of petroleum oils?

Ans. The term cracking as used by refiners and manufacturers of petroleum oils is applied by them to the decomposition that takes place in the latter part of the distilling processes employed by them. This so-called cracking process was recognized, and apparatus for its accomplishment was patented, as one that would enable the manufacturer to obtain a larger proportion of clear, comparatively colorless, light oils than was ordinarily obtained. The term is only applied by refiners to the latter part of distillations.

Int. 2. In your previous deposition in this case you gave some explanations of the decomposition which attends the distillation of petroleum, especially at the earlier stages of the distillation. Will you explain how the decomposition which takes place at that part of the distillation to which the term cracking is applied differs, if it does differ, from that decomposition which takes place in the previous stages of distillation?

808 Ans. Cracking, or decomposition, takes place throughout the process of distillation, unless extraordinary precautions are taken to prevent it at certain stages. The cracking in the earlier stages is of precisely the same kind as that of the latter stages of the process. They do not differ in kind.

Int. 3. Explain briefly in what way the different hydro-carbon bodies which exist in petroleum, or are formed in the process of distillation, differ from each other in their composition.

Ans. Petroleum consists of carbon and hydrogen, and it yields by distillation a great number of so-called hydro-carbons, the quantity, number, and kind of which may be determined by the mode of distillation to which the petroleum is submitted. Upon the application of heat to petroleum, extremely light, permanent gases and ethereal bodies, containing a comparatively small percentage of carbon, are produced. As distillation proceeds throughout the process, the proportion of carbon in the products and their densities, due to the presence of carbon, increase. Heavy, thick, hydro-carbon oils increasing in proportion of carbon contained, remain in the still. The heavier products contain a larger proportion of carbon than the lighter and first distillates. The exact construction of petroleum has never been positively determined, on account of the difficulty of distilling it without decomposing and mixing the proportions of hydrogen and carbon.

Int. 4. State whether or not the decomposition which takes place either in the earlier stages of distillation, or after that stage has been reached where cracking is resorted to, necessarily involves the decomposition of the petroleum into its ultimate elements of hydrogen and carbon; and, if not, what is the character of the change which takes place?

Ans. It does not. The change which takes place consists in the formation of lighter and heavier products; the former always containing both elements, but a smaller proportion of carbon; the latter containing a larger proportion of carbon. In other words, carbon is dropped out of the lighter products, and is retained in the heavier bodies, but still in a state of combination with hydrogen, and not, necessarily, deposited as carbon, unless the process be conducted to the last stage.

Int. 5. After the distillation has reached the stage at which the distillate begins to run yellow from the condenser, I understand
809 that the distillation may be so conducted as to produce a heavy oil of constantly increasing gravity, or it may, by what is termed cracking, be so conducted as to give a light oil. Explain how it is that the decomposition is effected in the latter case so as to give a light product instead of a heavy one.

Ans. When this cracking takes place the vapors of distillate, by condensing and falling back either into the hot vapors arising from the oil in the still or into the oil itself, are redistilled, and in this way are broken up or decomposed into lighter bodies than would otherwise pass over from the still. The heavy colored oils are thus cracked in the apparatus, and only light, comparatively colorless oils, containing a smaller proportion of carbon, pass over. The oils distil in the vapors of each other, and by redistillation, as accomplished in this process, are converted into lighter bodies.

Int. 6. In your preceding answer you state that carbon is not necessarily deposited as carbon, unless the process be conducted to the last stage. State now whether or not this last stage embraces the whole of that part of the distillation to which the term cracking is applied, or only the latter part of that part of the process.

Ans. By last stage I mean the extreme end of the distillation—that period when there is very little, if any, liquid remaining. The carbon present is combined and exists in a liquid form to very nearly the end of the distillation—as long as there is sufficient hydrogen to combine with it and retain it in a liquid form—long after the so-called cracking process of the refiners has set in.

Int. 7. In your previous deposition, you spoke of having had three years' experience as a practical manufacturer or distiller of petroleum. State what was your practice during that period as to the extent to which you carried the distillation of petroleum before removing the residuum from the still, and what was the character of such residuum?

Ans. In more than half of the stills it was my practice to distil off the lighter oils, leaving fifteen or twenty per cent. of residuum in the stills. This residuum was a thick, dark-green, heavy oily body. It contained no separated carbon, and was drawn off from the stills through a two or three inch pipe. Some of it was used for stuffing leather. It was very rich in combined carbon.

Int. 8. State whether or not, in reaching this percentage of
809 residuum, you cracked the oil in the latter stages of the process of distillation, and what you obtained as a distillate.

Ans. The oil was cracked, especially in the latter stages of distillation; my object being to obtain as much light burning oil and as little of the heavy distillates as possible. I obtained a very large but somewhat varying percentage of burning oil—more than in other stills then under my direction, which were not so well adapted for cracking as those in which I obtained the residuum referred to.

Int. 9. How was the heat applied to those stills when you obtained this residuum?

Ans. The heat was applied by fire alone under the stills, and in some cases carried round the sides of the stills through spiral flues. The heat employed was that of a naked fire alone.

Int. 10. State whether or not, when carrying on the distillation in this way, you had any deposit of coke adhering to the bottom of the still or lying loosely upon it.

Ans. I frequently went into these stills myself after distillations. I

never found any carbon on or about the bottoms of these stills—that is, below the level of the residuum that had been drawn out, as before stated. But on and about the tops of those stills there was deposited carbon adhering to and cemented on the iron, which proved that cracking to its extreme last stage had taken place in the vapors during distillation, but there was no deposited carbon on the bottoms, which were quite clean, or in the residuum.

Adjourned to 10 o'clock a. m., 26th inst.

JUNE 26, 1872.

Resumed:

Int. 11. State whether or not you would expect to find a deposit of coke on the bottom of a still, or the presence of separated carbon in the residuum, when petroleum of 43° gravity was distilled down to a residuum of 22 per cent., the distillate produced being illuminating oil; and whether or not such oil would yield illuminating oil down to that percentage of residuum without being cracked.

Ans. I should not expect to find coke or deposited carbon under such circumstances. I consider that the formation of either coke or separated carbon would be impossible. And if the petroleum had yielded only illuminating oil and residuum, cracking must necessarily have
811 taken place. I form this judgment from my practical experience and scientific investigations of this subject, conducted through a period of eleven years.

Int. 12. Explain a little more fully the difference in results which are obtained when distilling a body which undergoes decomposition, like petroleum, or a body, or a mixture of bodies, which do not undergo decomposition.

Ans. The difference is that between destructive distillation and fractional distillation. A familiar example of the former is the distillation of coal and the production of street-gas therefrom. This is a good representative of destructive distillation like that which takes place in the distillation of petroleum. The product, street-gas, does not exist already formed in the coal. The coal is destroyed in the process of producing gas, and it can never be reformed by mixing the products together. Neither can this gas be obtained mechanically or by other means than distillation from the coal. Destructive distillation or "cracking" of the coal is necessary to produce the gas. And, in the distillation of petroleum, the products are obtained by similar destructive distillation. The crude petroleum cannot be reproduced by the mingling of its products obtained by distillation. It has been destroyed as coal is destroyed in making gas, and this destruction takes place throughout the process of distillation. A familiar example of practical distillation is the separation of alcohol and water, or rum from beer. The products of such fractional distillation, when mingled together, reproduce the original mixtures. There is no destruction at any stage of this process. Numerous other examples might be cited, such as the distillation of water, which is not destroyed even when heated far above its boiling-point during distillation. Destructive distillation involves the destruction of the raw material, so that it cannot be reproduced from the products obtained. Fractional distillation is a simple separation of bodies already existing in the original material, the mingling of which will reproduce it.

Int. 13. Have you examined two specimens of products produced by Mr. Abbott, a witness in this case, and said by him to have been taken from Dr. Tweddle's cast-iron still; and have you read, or heard read,

the testimony given by Mr. Abbott and Mr. Merrill in respect to the presence of those substances in the still and its dome?

812 Ans. I have examined the specimens and heard the evidence read.

Int. 14. Have you examined a model of the cast-iron still produced by Dr. Tweddle, and his description of the manner in which it was constructed, and also his account of the circumstances attending the fire which destroyed his works, especially that part relating to the escape, at the time of the fire, of some heavy oils stored in the still, and its being burned under the still?

Ans. I have done so.

Int. 15. State whether or not, in your judgment, such deposits as those produced by Mr. Abbott, and described by him and Mr. Merrill, could have been produced by fire under the circumstances described by Dr. Tweddle.

Ans. It is my judgment that these products could not have been produced by the conflagration described by Dr. Tweddle. The presence of the dry coke, or carbon, in the dome of that still is a proof that cracking must have taken place to the last stage; and, judging from the nature of this coke, or deposited carbon, the cracking process must have been carried on for a long time, or for a considerable number of times, because the deposit of carbon obtained from a single distillation is leathery in character, or like a sprinkling of lamp-black, on the interior of the upper part of a still. After continued cracking distillation this deposit increases and becomes cemented together into a more or less porous mass, like the exhibit referred to. According to the explanation given by Dr. Tweddle, the quantity of heavy oil in the still would have been a few barrels only; and if this quantity had been cracked by the conflagration it would not have formed such a quantity of coke of the kind exhibited by Messrs. Abbott and Merrill. Moreover, judging from the model of the still and Dr. Tweddle's evidence, I do not think that this oil would have entirely distilled under the circumstances of the conflagration, there being an outlet at the bottom, caused by the breaking of some pipes; and the space under the still being filled with oil, by preventing access of air, would prevent sufficient combustion to have distilled the oil, if any had remained in the still, with a broken outlet-pipe.

Int. 16. Have you made any experiments in distilling oil by means of a vacuum, or by means of steam, which enable you to determine whether cracking may take place while distilling, either with a

813 vacuum in connection with steam and fire, or without steam? If so, state when the experiments were made, and generally how they were varied as to the use of fire, steam, and vacuum.

Ans. In the summer and fall of 1870 I made a series of ten distillations of petroleum for the purpose of my own instruction. These distillations were made always in the same still by the aid of fire, steam, and vacuum, fire and vacuum, fire and steam, and fire alone. They were conducted with unusual accuracy, and the results carefully noted in detail. The results, briefly, were that cracking of petroleum during distillation is prevented with difficulty under any circumstances, and that steam alone is a better auxiliary or preventive of cracking when used in connection with fire than the vacuum; but that cracking takes place with both or either, unless precautions were taken to prevent it.

Int. 17. Look at the account given by Mr. Merrill in a previous deposition, in answer to cross-interrogatory 3, on page 677, and state whether or not the apparatus and means described by him are the same employed by you, and whether Mr. Merrill took part in these experiments.

Ans. The apparatus and means employed are the same, and Mr. Merrill took an active part in all these experiments. There were also present other well-known experts from different parts of the country.

Int. 18. Will you refer to the patent to Dr. Tweddle, No. 99875, on page 686 of the record, and state whether or not you made the conditions of any of your experiments conform to the conditions, as you understood them, given in that patent for carrying out the invention there described?

Ans. I have made the desired reference, and will state that I made two distillations in exact conformity to the directions of that patent, as I understood them, exercising my best skill and judgment to produce the results claimed. The two experiments corresponded very closely in details and results.

Adjourned to 2.15 p. m.

Resumed:

Int. 19. If you have prepared a table showing the temperatures at different stages of the distillation in the four modes you have mentioned, and the gravities of the distillates at the several stages, will you
814 produce it as an exhibit, and explain the manner in which it is made up and the manner of using the still in each of the experiments?

Ans. I now hand to the examiner such a table, which I have drawn up, (marked "Complainant's exhibit 137,") showing detailed results of four distillations made in 1870. In this table the left-hand column shows the number of gallons distilled off at each observation. The other columns show the densities and temperature of the vapor at the end of every five gallons distilled off during the four experiments. In other respects I think the table explains itself.

Int. 20. In those several modes of conducting the experiments, did the distillate reach any given gravity—say thirty-eight degrees—after distilling off the same number of gallons, or did the experiments differ in this respect; and, if so, to what extent?

Ans. The experiments differed in this respect as follows: A density of thirty-eight degrees Beaumé was obtained when between seventy-five and eighty gallons has been distilled off by the aid of fire, steam, and vacuum. The same density of thirty-eight degrees was obtained when about eighty-six gallons had been distilled off by the aid of fire and vacuum. The same density of thirty-eight degrees was obtained when ninety gallons had been distilled off by the aid of fire and steam. The density of thirty-eight degrees was obtained when about one hundred and twenty gallons had been distilled off by the use of fire alone. These data and other results of these experiments show conclusively that somewhat less cracking takes place in the still when fire, steam, and vacuum are used together than under the conditions of the other experiments; also that the employment of fire and steam prevents cracking quite as much as the employment of fire and vacuum, while with fire alone the proportion of cracking is much greater. The minimum proportion of cracking when distilling crude petroleum is obtained when using fire, steam, and vacuum. The maximum proportion of cracking is obtained by the use of fire alone, as proved by these experimental distillations, which were made in the same still in each case.

Int. 21. Does the density of the distillate indicate whether cracking has taken place, and the extent to which it has taken place, if it has?

Ans. The density indicates the extent to which cracking has taken place in these experiments.

Int. 22. State whether or not these experiments were conducted
815 in such way as to secure the greatest amount of cracking or the least amount; in other words, were you endeavoring to procure the largest amount of high oils, or the largest amount of heavy oils which you could?

Ans. Our endeavor was to produce the least amount of cracking and the greatest amount of heavy or lubricating oils. In this respect the experiments are exact comparisons of the four different processes employed.

Int. 23. Do you find anything in the records of the experiments in which a vacuum is employed which determines whether or not cracking actually took place in connection with a vacuum? If so, point it out, and explain the circumstances under which that result was obtained. I use the term cracking now as used by manufacturers as indicating the breaking up of the heavy oils into oils light enough for illuminating oils.

Ans. By reference to the tabulated results which I have introduced, it will be observed that in the experiments of September 1st and 12th, in the former of which fire, steam, and vacuum were employed, and in the latter fire and vacuum, that the observations near the end of the distillations show a largely increasing number, or a lighter density of oil obtained than previously. For instance, in the former distillation, when one hundred and twenty gallons had been distilled off, the density was twenty-seven degrees Beaumé. When one hundred and twenty-five gallons was distilled off, the density had gone up, or lightened, to thirty-two and six-tenths degrees; and when one hundred and twenty-seven gallons had been distilled off, the density was much lighter, at forty-two and nine tenths degrees. In the latter experiment a similar result will be observed between the quantities of one hundred and fifteen and one hundred and twenty gallons. This cracking at the end of these distillations was due to decreasing the speed at which the process had been conducted.

Int. 24. In the experiment with fire, steam, and vacuum, what changes were made either in the fire, the introduction of steam, or vacuum, which gave you the light product of forty-two and nine-tenths degrees?

Ans. The fire was withdrawn, the distillation proceeding by the heat from the brick-work surrounding the still; and steam was gradually shut off, the vacuum being maintained, and steam again introduced, when the lighter products were obtained. The shutting off and introduc-
816 tion of steam at this time did not affect the cracking, as the densities of condensed light oils were observed at the tail-pipe very frequently; and in the last two gallons distilled the density was from forty-two and one-half to forty-four degrees. But the density of these two gallons when mixed together was, as before stated, forty-two and nine-tenths degrees.

Int. 25. What do these tables show as to the temperatures under which distillation took place in the several modes, and what do they show as to the relative effect of steam and vacuum in reducing the temperature?

Ans. Reference to the table shows that steam alone reduces the temperature of the oil in vapor at the point when cracking is most likely to take place, quite as much as steam and vacuum together, and considerably more than vacuum alone. In other words, that steam, by lifting these vapors out of the still better than the vacuum-pump, prevents their decomposition proportionably. It will be observed that a temperature of about five hundred and eighty degrees was obtained in the experi-

ment with fire, steam, and vacuum, when between one hundred and five and one hundred and ten gallons had been distilled off. In the experiment with fire and vacuum this temperature was obtained when ninety-five gallons had been distilled off. While in the experiment with fire and steam this temperature was not obtained until between one hundred and five and one hundred and ten gallons had been distilled off. But in the experiment with fire alone this temperature was reached when between eighty and eighty-five gallons had been distilled. In this table some of the higher temperatures are followed by a question-mark, indicating that the accuracy of the thermometer had been destroyed by the previous temperatures to which it had been exposed in the experiments.

Int. 26. Have you read the account given by Mr. Cuddy, in his deposition at Pittsburg not long since, of the conditions and results of an experiment in distilling twenty-five barrels of Franklin oil?

Ans. Yes; I have done so.

Int. 27. In this experiment Mr. Cuddy states that the oil was first distilled with superheated steam and vacuum, and that twenty-five per cent. was distilled over as illuminating oil in three hours, the distillate reaching a gravity of thirty-eight degrees, distillation being carried on at the rate of about two barrels an hour. The residuum was then placed in another still, and by means of superheated steam and vacuum
817 fifty-five per cent. of neutral topaz oil was distilled in two and one-half hours, or at the rate of five barrels per hour. State whether or not this difference in the rate at which distillation took place was favorable to the cracking of the oil in the first still, and unfavorable to its cracking in the second still, when the neutral topaz was obtained.

Ans. The comparatively slow rate of speed of the earlier part of this distillation was certainly favorable to cracking, or to the production of light oil; while the rapid rate of distillation of the latter part was unfavorable to cracking and the best way to lift out the lubricating-oils from this still. The slow rate of distillation in the early stages accounts for the large proportion of light oil which he says he obtained. The quantity of light oil and the slowness of the distillation are evidence that cracking was successfully accomplished during his distillation.

Int. 30. Have you made any experiments recently with the Franklin oil in order to determine what quantity of light oil can be obtained without cracking, or whether twenty-five per cent. can be obtained without cracking, before the distillate falls below thirty-eight degrees? If so, state the circumstances of the experiment and the results obtained.

Ans. On the 18th of the present month, a distillation of Franklin petroleum was performed in my presence and under my direction. The apparatus used was the same as that described by Mr. Merrill in his answer to the twenty-fifth direct interrogatory of his recent deposition. The Franklin petroleum put into the still yielded a distillate having a density of thirty degrees when less than nine per cent. had been distilled over and condensed. But when twenty-five per cent. had been distilled off, the density had gone down to thirty-three and seven-tenths degrees. There was undoubtedly some cracking at the commencement of this distillation, but still we obtained less than nine per cent. of distillate before reaching a density of thirty-eight degrees, and it is impossible to distil Franklin petroleum and get twenty-five per cent. having a lighter density than thirty-eight degrees without cracking considerably. I have preserved samples of the distillates obtained in this experiment, representing every three per cent. of the early and later stages. I now produce a sample, marked "Complainant's Exhibit 138,"

which is of the distillate when it had reached a density of thirty-seven and four-tenths degrees, and when nine per cent. had been distilled over.

I also produce a sample, marked "Complainant's Exhibit No. 139,"
818 which has a density of thirty-three and seventh-tenths degrees, and is of the distillate obtained when twenty-five per cent. had passed over and been condensed. The densities given are corrected to sixty degrees F. The Franklin is one of the most stable petroleums. It does not crack so easily as the common run of Pennsylvania oils, and naturally yields a larger proportion of heavy distillates. In my experiment, after obtaining twenty-five per cent., we saved a second twenty-five per cent. in a receptacle by itself. This received a light chemical treatment, and I now hand a sample of it to the examiner, marked "Complainant's Exhibit No. 140." It had a density of thirty-one and six-tenths degrees, and has the characteristics of a good lubricating oil like that known as neutral topaz. After obtaining this second twenty-five per cent. the distillation was continued, and the products distilled in the third twenty-five per cent. were varied in density from twenty-five degrees to thirty and six-tenths degrees, by altering the speed at which the process was continued. In other words, it was shown by the densities and other conditions that cracking could be effected on this stable petroleum in a still where fire, vacuum, and steam were employed as auxiliaries. The residuum remaining in the still was twenty-one per cent. of the crude oil used. I now produce a sample of this residuum, marked "Complainant's Exhibit No. 141." The time employed was thirty-nine minutes for running off the first twenty-five gallons, or twenty-five per cent. of light oils; one hour for running off the second twenty-five gallons, or twenty-five per cent. of lubricating-oils; and forty-seven minutes for running off the third twenty-five gallons, or twenty-five per cent.

Int. 31. Does the residuum which you have produced contain any separated carbon, or was any separated carbon or coke deposited in the bottom of the still?

Ans. There was no separated carbon in the residuum or in the bottom of the still. All the carbon present is combined, and in a liquid form.

Int. 32. As the result of all your own experiments and of the experiment of Mr. Cuddy, what conclusion do you draw as to the practicability of carrying on the cracking process, as it is understood by manufacturers, in a vacuum still with superheated steam, upon crude
819 petroleum of forty-three degrees gravity, until you reach a residuum of twenty-two per cent., so as to produce refined oil?

Ans. I think it is proved by these experiments that the cracking process so called may be conducted under such conditions so as to yield this proportion of a "refined" oil.

Int. 33. You have stated, in reference to your tables of experiments of 1870, that they show that any degree of density of the distillate which may be named is reached at an earlier stage of the distillation where steam, fire, and vacuum are used than where fire alone is used. If such be the case, would not the oil commence running from the still of a yellow color and too heavy for illuminating oil at an earlier stage of the distillation than when fire alone was used; and if cracking was then brought into play would it not be carried on through a longer stage of the distillation before a given percentage of residuum, say twenty-two per cent., was reached?

Ans. The colored oil would run from the still at an earier stage, and the cracking process, in the refiner's sense of the term, would be con-

tinued through a longer time before reaching the percentage of residuum named.

Int. 34. At the time you made the experiments embraced in the table which you have produced, had you any knowledge of the construction of Dr. Tweddle's cast-iron still, or that he claimed that the decomposition in cracking of oils could not take place in a vacuum still, and were these experiments made with any reference to their bearing upon that question?

Ans. I had no knowledge of Dr. Tweddle's cast-iron still, nor of the claim referred to; and these experiments were not made with reference to the bearing that they might have on this part of the subject. The experiments were made, as in every other scientific investigation, for the purpose of obtaining an accurate knowledge of the substance under examination when subjected to different conditions and tests. The experiments constituted an investigation of petroleum, and the results obtained happened to answer the claims set forth in Dr. Tweddle's depositions.

Adjourned to June 27, at 10 a. m.

820 JUNE 27, 1872.

Resumed:

Int. 35. In his answer to 18th interrogatory, in his recent deposition, Dr. Tweddle refers to the circumstance that the lead-joints in his cast-iron still were not melted when distillation was carried on, as showing that no cracking could have taken place in that still. Have you had an opportunity to make any observations which would show whether or not such conclusion was justified by the fact referred to, especially if the distillation were stopped at a twenty-two per cent. residuum?

Ans. I have made observations at different times which show that cracking may take place when the temperature is not so high as the melting-point of lead. I have repeatedly cracked oils in stills provided with lead joints without the lead. The vapors of petroleum products are not good conductors of heat, which in a measure accounts for the fact that oils requiring steam of a high temperature for distillation do not produce vapors hot enough to melt lead. The fact that Dr. Tweddle's lead-joints showed no signs of melting, simply indicates that the temperature of those parts of the apparatus had not reached the melting-point of lead, nothing more.

Int. 36. In your recent experiment did you observe the difference in vacuum between the still and the condenser or pump?

Ans. In the experiment performed on Franklin petroleum before referred to, the apparatus was provided with two vacuum gauges, one on the still, the other attached to the condenser near the tail-pipe. I made some twenty observations of the vacuum and in almost every instance used both gauges; and there was at no time a difference between them of over one-half of an inch of mercury. The vacuum in the condenser is but very little if any less than that in the still.

Int. 37. What was the vacuum which you maintained during this experiment?

Ans. In this particular experiment the vacuum varied from eighteen to twenty-two inches.

Int. 3. Suppose the vacuum of the still was twenty-nine inches, how much difference would there have been between that and the condenser, or air-pump, supposing a perfect vacuum to be made at the latter point?

821 Ans. That would depend much on the barometric pressure of the atmosphere. A perfect vacuum is, theoretically, about thirty inches, sometimes less.

Int. 39. What causes the vapors in the still to move towards the condenser and air-pump, and upon what does the rate at which they shall move depend?

Ans. The movement of these vapors is caused by their tension, and the rate at which they move depends entirely upon this, unless lifted out by mechanical means. When the vacuum is nearly the same in condenser and still, as is the case in an ordinary vacuum apparatus, the rate of motion of the gases is comparatively slow and the conditions for cracking are favorable.

Int. 40. Compared with the rate at which air and atmospheric pressure would rush into a complete vacuum, what would be the rate at which the mixed vapors of oil and steam in a still of twenty-nine inches vacuum would move towards the condenser and air-pump?

Ans. Air is one of the most elastic bodies known, and would rush into a vacuum with immense force; while, on the contrary, the vapors of petroleum are among the bodies having the least elasticity of any known to physicists. And their motion in the vacuum still depends entirely upon the rate of ebullition or boiling, and would be hardly perceptible if ebullition of the oil in the still was not taking place. In other words, air is very elastic. The vapors of petroleum are almost inert. Under the conditions their motion would be relatively slow compared by that of air.

(The defendants object—by consent—to direct interrogatories Nos. as inquiring of matters not open to proof by this witness at this stage of the case.)

Cross-examination by Causten Browne, esq., counsel for respondent:

Cross int. 41. You say the cracking process, so called, "was recognized, and apparatus for its accomplishment was patented," etc. Did you ever see this patent?

Ans. I have seen patents for apparatus for cracking hydrocarbon oils. I have seen several such patents, especially the one of Luther Atwood, of about 1860, I think, but am not certain. It is an American patent. The results obtained by cracking were recognized and the conditions necessary were known previous to the date of Mr. Atwood's
822 patent, but I think this patent is the first one in which the term "cracking" is employed.

Cross-int. 42. How early was the "cracking process," whether called by that name or not, known and practised in the distillation of hydrocarbons?

Ans. Cracking, as applied to coal in the production of street-gas, was practised very early—more than one hundred years ago. The unstability and ease with which liquid hydrocarbons cracked when undergoing distillation was known to chemists as early as about 1850. I believe that refiners and manufacturers of coal oils did not employ what refiners now term "the cracking process"—I mean by this the continued production of illuminating oil in the latter part of the distillation—until about 1860. I think Mr. Atwood was the first to carry on the so-called cracking process of refiners on a large scale, producing only light oils and residuum, or coke.

Cross-int. 43. Was it practised on a smaller scale by any other person before him?

Ans. Not to my knowledge, excepting in a chemist's laboratory.

Cross-int. 44. You say that in the decomposition which takes place in the earlier stages of distillation—earlier than that at which what is technically known as cracking is resorted to—carbon is dropped out of the lighter products. What then becomes of it?

Ans. I used the expression "dropped out" in order to make my explanation clear. It is dropped out in combination with some hydrogen in a liquid form. In other words, a heavy body rich in carbon is produced, and separated by destructive distillation from lighter bodies which are rich in hydrogen. But the carbon is not separated in an elementary form and dropped to the bottom of the still.

Cross-int. 45. How is the fact of such dissociation of the carbon from the whole body, with which it was united before, ascertained?

Ans. By chemical analysis of the products. The fact that destructive distillation has taken place is proved by remingling the products obtained, which do not reproduce the original substance.

Cross int. 46. Has this chemical analysis and this reunion at the stage of the distillation in question ever been actually made by yourself?

Ans. I have made such analysis and such remixing of the prod-
823 ucts at different times for the purposes of scientific investigation. It is considered an interesting scientific fact.

Cross-int. 47. When did you do this first?

Ans. Some time between the summer of 1861 and 1866, during the time when I was most busily employed in working with petroleum. I made some of these observations with the assistance of my father, Dr. A. A. Hayes.

Cross-int. 48. Did you preserve the records, if any, of your chemical analysis?

Ans. I am not sure. I will look and see if I have the numerical results.

Cross-int. 49. In your judgment, can any fraction, if so, how much, be removed from petroleum of say forty-seven degrees Beaumé, by mere agitation, in a vessel in which there is a vacuum of say thirty inches, without the application of steam or heat in any form?

Ans. I think it very probable; I never tried it. The quantity obtained must depend upon the freshness of the petroleum and the length of time it is kept in the apparatus. Petroleum is so unstable that it changes when exposed to the action of atmosphere. By this change I mean that it evaporates, the residuum thickening, and the quantity of evaporation depends again upon the length of time of its exposure in open vessels.

Cross-int. 50. When the carbon is dropped out in the early stage of decomposition, as you say, and retained in the heavier bodies, but not necessarily deposited as carbon, is the presence of such dissociated carbon discernible by any examination of the mass then remaining in the still?

Ans. It is not dissociated by itself. It is still in liquid combination, and cannot be positively discerned by any method other than that of analysis, although there are indications of its presence, such as an increased density Beaumé.

Cross-int. 51. Is the operation of cracking attended by the formation of non-condensable gases; if so, at what stage in the distillation do these begin to be formed?

Ans. The operation of cracking, in its true sense, when conducted throughout the distillation, is controlled by the mode of operating and the apparatus employed. Under certain conditions, the whole of
824 the petroleum may be converted into uncondensable gases and

carbon. Under other conditions most of the petroleum is converted into light hydrocarbons and residuum, or coke. Sometimes the uncondensable gases appear at the earliest stages of the distillation; at other times they are formed throughout the whole distillation. I have myself seen two stills, supposed to be under like conditions, one of which gave uncondensable gases throughout the distillation, while the other gave off most of the gases at the earliest stages of the process. And I have, again, seen volumes of uncondensable gas given off near the end of the process.

Cross-int. 52. Referring to the three years' experience which you say you have had as a practical manufacturer or distiller of petroleum, state when and where that was?

Ans. I began in the summer of 1861, in the town of Winthrop, near Boston, and was constantly employed, until the summer of 1864. I was employed by Alonzo Farrar, and the firm of A. Farrar & Co. I had full control of the works, and made many experiments and improvements, which have been of much service to me in my consultations and general practice with other manufacturers since that time. I had previously the practical experience of my father, who was then associated with me, as a guide.

Cross-int. 53. What was your position in the establishment you refer to; were you superintendent?

Ans. I was chemist and superintendent. I resided near the works, and had foremen and workmen under my personal direction.

Cross-int. 54. When distillation is proceeding under such conditions as to produce the flocculent deposit inside of the stand-pipe, as you have described, is there a decomposition also of heavy vapors which do not come in contact with the stand-pipe, but descend into the heavier strata of vapor, or into the oil itself?

Ans. Yes; but the decomposition is not as complete as that which takes place near and on the cooled portions of the apparatus. The carbon separated on the stand-pipe indicates that complete decomposition has taken place. The vapors at these parts of the apparatus have been resolved into lighter vapors and elementary carbon, which separates as such, and is deposited on the iron, while the inner and hotter portions of vapor, in decomposing, change into lighter vapors and heavier vapors rich in carbon in a liquid form; and probably the current and motion is more rapid in the inner parts of the apparatus, so that decomposition is not effected to such an extent in this part.

825

Cross-int. 55. You are practically acquainted, I suppose, with the process referred to by Mr. Merrill in his first deposition in this case, in which, instead of slowing the fire at a certain stage to crack the heavy vapors, the distillation is hastened for the purpose of producing lubricating oil?

Ans. I am familiar with the process referred to, and have practised it myself at Winthrop and elsewhere.

Cross-int. 56. What gravity of petroleum was used in the experiments you have mentioned as conducted by yourself and Mr. Merrill in vacuum distillation? The gravity of that used in the experiments of September, 1870, was forty-two and one-half, as stated in the table Exhibit 137.

Ans. In the whole series of experiments made in 1870, and there were a number not mentioned in the table, the petroleum was all drawn from one receptacle and had the density given in the table referred to. In the experiment made with Franklin petroleum the crude oil had a density

of about thirty-two degrees, according to the best of my recollection. I did not make a record of it at that time. I have a sample at hand and hand it to the examiner, as desired, marked "Exhibit No. 141."

Cross-int. 57. What thermometers did you use in the experiments shown in table Exhibit 137?

Ans. These instruments were provided by Mr. Merrill. There were a large number of them, (I should think at least twelve,) from which I selected the most accurate by carefully testing them. These tests of the thermometers and the experiments were performed in the presence of several eminent experts. I am prepared to swear to the accuracy of the Fahrenheit thermometers used. The thermometers were not used for more than one distillation.

Cross-int. 58. Was your vacuum gauge a mercury gauge or a dial gauge?

Ans. The two gauges used were dial gauges showing the number of inches of mercury. There are different kinds of dial gauges.

Cross-int. 59. Suppose you were using superheated steam at one hundred pounds pressure, as an auxiliary of distillation of petroleum, maintaining a vacuum in the still of twenty-eight or twenty-nine
826 inches; are you able to form a sound judgment as to the rate at which the vapors of oil and steam would pass away to the condenser?

Ans. I think I am prepared to form such an opinion. Steam is very elastic. It expands more than any vapor that I know of; whereas the vapors of petroleum are not elastic, and do not expand nearly so much. They are among the least expansive of any known vapors. Now, under the conditions that you have given, the vacuum being the same in the condenser and in the still, and so very perfect a vacuum that there can be but very little steam entering the still, the rate at which the vapors would pass to the condenser must depend mainly upon the ebullition of the oil in the still, and would be very slow with so nearly perfect a vacuum. In practice it is next to impossible to obtain a vacuum so nearly perfect as the one you have named, under such conditions.

Cross-int. 60. Your experience of vacuum distillation of petroleum has been confined, I believe, to your use of the vacuum still in the experiments heretofore mentioned?

Ans. My experience in the vacuum distillation of petroleum is confined to a considerable number of experiments made in 1870 and 1872 with the still referred to; but I am quite familiar with vacuum apparatus, as applied in the arts for other purposes, where the importance of getting a complete vacuum is quite as great as when distilling petroleum; and I have consulted with refiners using vacuum stills in the distillation of petroleum, from whom I have drawn information concerning the modus operandi. I have also had much experience with vacuum pumps, and know how difficult it is to obtain perfect vacuums in large chambers or vessels.

Cross-int. 61. Who are the refiners using vacuum stills in the distillation of petroleum with whom you consulted?

Ans. I forget the names of some of them. But I remember John Howarth, of Boston, was one, and also two gentlemen from Rochester, N. Y., and another from Baltimore, in Maryland. These consultations had reference to the manufacture of petroleum with what is known in commerce as "vacuum oil" for tanners' and lubricating purposes. I have had many consultations on this subject with Charles Toppan, who has described to me different forms of vacuum apparatus used in distilling petroleum that he has seen. I may also mention conversation with

827 Mr. James Young, in Edinboro', Scotland, upon this subject, the oils which he then distilled being coal oils similar in physical character to petroleum; also other consultations with Mr. Archibald, an Englishman, who erected works in the provinces and in England, if I recollect rightly.

Adjourned to 28th, at 11 a. m.

S. DANA HAYES.

Complainant's exhibit 137.—*N. A. P., Ex'r.*

TABLE SHOWING RESULTS OF DISTILLATIONS.

The same still and apparatus was used for all these distillations, and 148 gallons of steamed crude petroleum, having a density of 42½ degrees Beaumé, was operated upon in each case. Temperatures and densities were taken for every five gallons distilled.

Number of gallons distilled.	Fire, steam, & vacuum, Sept. 1, 1870.		Fire and vacuum, Sept. 12.		Fire and steam, Sept. 13.		Fire alone, Sept. 14.	
	Temperature of vapor.	Density. Beaumé.	Temperature of vapor.	Density. Beaumé.	Temp. of vapor.	Density. Beaumé.	Temp. of vapor.	Density. Beaumé.
5	222° F.	57.6°	225	54.6	250	58.6	298	58.4
10	256	57.6	236	56.6	272	58.	308	57.9
15	266	55.6	224	55.7	288	56.7	316	57.1
20	266	54.1	266	55.8	294	56.9	326	56.8
25	278	53.2	282	53.6	295	56.1	334	56.1
30	280	52.9	288	52.5	302	55.3	344	55.4
35	287	50.4	302	51.4	316	54.1	356	54.9
40	309	48.5	316	50.9	332	54.2	369	54.
45	321	46.7	334	49.3	352	52.2	382	52.5
50	332	45.2	365	47.9	368	50.8	396	51.8
55	348	43.	384	45.4	384	49.6	415	51.1
60	361	42.2	396	43.7	400	48.3	439	49.7
65	381	41.2	428	43.3	422	46.8	466	48.1
70	406	37.5	460	42.3	440	44.4	494	47.
75	430	37.5	484	41.1	446	42.5	523	46.2
80	449	35.9	498	39.9	457	41.6	556	43.3
85	474	34.3	516	38.5	480	39.	590	42.2
90	494	34.5	542	37.4	493	38.2	620?	41.5
95	512	30.8	580	36.3	524	37.	....	40.
100	528	29.4	625?	35.2	548	34.7	....	40.
105	559	28.3	....	34.	564	33.2	....	39.4
110	650?	27.8	....	33.9	585	31.	....	39.
115	686?	25.7	....	35.5	604	30.6	....	38.6
120	800?	27.	....	38.	625?	30.	....	37.8
125	....	32.6	....	....	....	28.4	....	37.2
130	....	....	....	....	....	28.5	....	37.2
135	....	....	....	....	....	....	....	37.8
127	....	42.9	....	....	....	....	....	....
130½	....	....	....	....	....	29.	....	....
135¾	....	....	....	....	....	....	....	48.

828 *Statement of sales of illuminating oil, made by and for account of the Downer Oil Works, located at Corry, Erie County, and State of Pennsylvania, from November* 1, 1864, *to April*, 1868, *inclusive.*

	1864.	1865.	1866.	1867.	1868.
	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.
January	.....	47,906½	102,809½	76,714	19,327⅜
February	.....	40,534½	78,264⅜	80,475	5,290⅜
March	.....	53,371½	92,766	71,214⅜	3,245
April	.....	50,891½	97,962⅜	99,567½	1,208¼
May	.....	55,084	83,465⅜	35,256½	.....
June	.....	87,277½	77,701½	119,117¼	.....
July	.....	89,238½	55,229	72,924⅜	.....
August	.....	102,656⅜	86,900⅜	159,819⅜	.....
September	.....	121,918⅜	81,936	80,996⅜	.....
October	.....	111,245½	109,822⅜	122,502⅜	.....
November	41,949¼	76,542½	92,280¼	38,267	.....
December	45,340	82,502¼	41,604⅜	54,315	.....

829 *Respondent's exhibit No.* 29.

The United States of America to all to whom these letters-patent shall come:

Whereas Herbert W. C. Tweddle, of Great Britain, has alleged that he has invented a new and useful improved apparatus for distilling coal-oil and other substances, which he states has not been known or used before his application, has made oath that he is a subject of Great Britain, that he does verily believe that he is the original and first inventor or discoverer of the said apparatus, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said apparatus, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Herbert W. C. Tweddle, his heirs, administrators, or assigns, for the term of seventeen years from the fourth day of February, one thousand eight hundred and sixty-two, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said apparatus, a description whereof is given in the words of the said Herbert W. C. Tweddle in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand at the city of Washington this fourth day of February, in the year of our Lord one thousand eight hundred and sixty-two, and of the Independence of the United States of America the eighty-sixth.

[L. S.] CALEB B. SMITH,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

D. P. HOLLOWAY,
Commissioner of Patents.

830 The schedule referred to in these letters-patent and making part of the same.

To whom it may concern:

Be it known that I, Herbert W. C. Tweddle, an alien and subject of the Queen of Great Britain and Ireland, have invented a new and useful improvement in the apparatus for distilling petroleum or any other hydrocarbon oil or fats of any description, and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a perspective view of the apparatus.

Figure 2 is a longitudinal section through the line *a a* of figure 1.

Figure 3 is a cross section through the line *b b* of figure 1.

Figure 4 is a perspective view of the coil steam-pipe F, detached from the still.

Figure 5 is a perspective view of the oil-charging pipe D, and a distributer E.

Figure 6 is a perpendicular section through the line *c c* of figure 5.

Like letters in all the figures represent the same parts of the apparatus.

The nature of my invention consists in an apparatus for distilling petroleum or any other hydrocarbon oil or fats of any description by means of superheated steam, so that fire is dispensed with in proximity to the still, thus rendering the process of distillation much safer than in the usual mode, and insuring permanent soundness to the still and pipes.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation:

A is the base for the still and its appurtenances.

B is the still, which rests on the pedestal C.

D is the oil-charging pipe connecting the still to the reservoir; the latter is not shown in the drawings. The pipe D has a stop-cock, *a*, to cut off the supply of oil when necessary.

E is a steam-distributor or blow-pipe. The radial arms *b* and the rim *c* are perforated with holes, *d*, to insure an equal distribution of superheated steam through the still.

The steam pipe F is provided with a stop-cock *e*, a blow-pipe *f*.

831 G is the dome of the still.

H is a discharging-pipe, through which the refined oil flows and passes through the series of condensing-pipes I, which are arranged in the condensing-tank J; said tank has a stream of cold water constantly flowing into it; near its top it has an overflow-pipe, *g*. The residuum from the oil runs from the bottom of the still B into the waste-pipe K; leading from the bottom of the still, said pipe has a stop-cock *h*, so as to only open the pipe when necessary to discharge the residuum.

L and M are receivers, which are on the pedestal C, and into which the oil passes from the condensing pipes I through the pipe N and branch pipe O, which latter is provided with stop-cocks *i j*, for the purpose of cutting off the supply of oil into the receiver. The latter cock is seen in figure 3.

P and Q are oil-discharging pipes of the receivers L and M. They have stop-cocks *k* and *l*. At the top of the receivers are air-cocks *m* and *n*, which are opened when a vacuum is to be destroyed.

R is a device for producing a vacuum, which I denominate a vacuum apparatus, which I use to produce a vacuum in the receivers L and M,

and back through the condensing-pipe to the still, for the purpose of producing a flow of oil therein from the still B; said vacuum apparatus connects with the receivers by means of the branch pipe S, which has stop-cocks *o* and *p*. The said vacuum apparatus has a vacuum chamber at or near its middle, of globular form, which connects, by means of a pipe, with the branch pipe S. I do not confine myself, however, to this form, as the form may be varied without materially injuring the effect of the chamber. And from said chamber there extends upwards an outlet pipe, which is made funnel shaped at its outer end.

T is a steam-emission pipe, which connects with the vacuum apparatus R. It has a stop-cock, *q*, for cutting off the steam from the vacuum apparatus, and destroying or regulating the vacuum. The receivers L and M are used alternately, the one not in use having its connection cut off with the oil branch pipe O and the vacuum apparatus R.

The operation is as follows:

After the still is charged, I heat the contents with steam, which is let into the pipe F; then I turn the steam on the hurricane R, which immediately commences to produce a vacuum in the receiver L and pipes leading to the still B, and distillation becomes very rapid. When the receiver L is full, I turn the keys of the stop cocks *i* and *o* to cut
832 off its connection with the oil branch pipe O and the vacuum apparatus R, and open the communication of the receiver M with said pipe and hurricane. While this receiver is being filled I empty the receiver L by opening the cock *k*, and when the receiver M is filled with oil I reverse the operation of the receivers alternately.

The object of my improvement is to preclude the necessity of having fire in or near the building in which the operation of distilling is carried on, and to do that, which has been hitherto attended with considerable danger, perfectly safe. It obviates, besides, the continual annoyance and derangement of the business which frequently occurs in the old mode by the cracking or burning out of the still, leakage of pipes, etc. No leakage from defective joints can possibly occur, so that the gas would escape, as the pressure of the atmosphere from without is greater than the internal pressure.

Another advantage is having the products of distillation received in the immediate vicinity of the still, so as to have the whole operation under the eye of the workman. The apparatus can be arranged with any still without any derangement of the former.

The coil in the interior of the still is for the purpose of heating the oil up to distilling temperature. The blow-pipe is used when the operator thinks it desirable.

Having thus fully described the construction and operation of my improvement in stills for distilling petroleum or any other hydrocarbon oil or fats of any description,

What I claim therein as new, and desire to secure by letter-patent, is:

First. I claim the vacuum-apparatus R, with which, by the use of steam, I produce a vacuum.

Second. The use of the vacuum apparatus R, arranged substantially as described, in combination with the receivers L and M, or their equivalents.

Third. The use of the vacuum apparatus R, in combination with the steam-pipe F, arranged in the interior of the still, substantially as described.

Witness my hand and seal this day of October, A. D. 1861.
HERBERT W. C. TWEDDLE. [SEAL.]

Witnesses:
JOHN H. BAILEY.
H. SPROUL.

833 *Respondents' exhibit No. 30.*

Re-issue No. 2404.

The United States of America to all to whom these letters-patent shall come:

Whereas Herbert W. C. Tweddle, of Pittsburg, Pennsylvania, has alleged that he has invented a new and useful improved apparatus for distilling coal-oil and other substances, (for which letters-patent were issued to him dated February 4, 1862; which letters having been surrendered by him, the same have been cancelled, and new letters ordered to issue to him on an amended specification,) which he states has not been known or used before such invention; has made oath that he is a subject of Great Britain; that he does verily believe that he is the original and first inventor or discoverer of the said invention, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents praying that a patent may be issued therefor:

These are, therefore, to grant, according to law, to the said Herbert W. C. Tweddle, heirs, administrators, or assigns, for the term of seventeen years from the fourth day of February, one thousand eight hundred and sixty-two, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said invention, a description whereof is given in the schedule hereunto annexed and made a part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent-Office to be hereunto affixed.

Given under my hand, at the city of Washington, this twenty-seventh day of November, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States of America the ninety-first.

[L. S.]

W. T. OTTO,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

T. C. THEAKER,
Commissioner of Patents.

834 UNITED STATES PATENT-OFFICE.

Improved apparatus for distilling coal-oil and other substances. Herbert W. C. Tweddle, of Pittsburg, Pennsylvania. Letters-patent No. 34324, dated February 4, 1862; re-issue No. 2404, dated November 27, 1866.

Specification.

To all whom it may concern:

Be it known that I, Herbert W. C. Tweddle, a citizen of England,

and a resident of Pittsburg, in the State of Pennsylvania, have invented a new and useful improvement in the process of distillation of petroleum and other hydrocarbon oils or fats of any description; and I do hereby declare that the following is a full, clear, and exact description of my said invention and of the apparatus which I employ in its practical application.

My invention consists in distilling petroleum and other hydrocarbon oils and fats under a vacuum or partial vacuum, in combination with the use of steam for producing the vaporization of the article to be distilled. Also in the use of superheated steam for distilling hydrocarbon oils and fats under a vacuum or partial vacuum.

The principal objects of my invention are to conduct the operation of distillation at a lower and more uniform degree of heat than is required by the ordinary modes of distillation, and to remove the danger arising from the direct application of fire to the stills containing the oil to be distilled. In the distillation of petroleum by means of fire applied to the stills, the heat requires to be run up from 530° to 580° Fahrenheit, in order to distill over the heavy products at the latter part of the operation. Such a high heat injures the stills and causes them to leak, and many serious accidents have occurred from this and other causes incident to the proximity of fire to these highly inflammable oils and the gases generated therefrom in the process of distillation. It is
835 also very difficult to regulate the heat of a furnace so as to carry on the distillation to the best advantage, and the consequence is that a large amount of oil is lost by the destructive distillation of the oil and the formation of permanent gas.

If the process of distillation is carried on under a vacuum, (or partial vacuum,) the heat required is considerably less, being only about 380° Fahrenheit, in cases where 580° would be required without the vacuum. To obtain the degree of heat (say 380° Fahrenheit) required at the latter stages of the process of distillation by the use of steam, it is necessary to have a pressure of about 200 lbs. to the square inch in the steam generator, which is fraught with danger, and is liable *ot* injure the steam pipes and stills, and cause leakage. Thus, although the heat produced by steam is much more beneficial, so far as the effect on the distillate is concerned, the difficulty and danger attending the production of the high temperature required at the latter part of the operation, even if a vacuum is created in the still, renders its adoption in this way unadvisable. By superheating the steam, however, this difficulty is effectually surmounted, because much less pressure is required, so that by the use of superheated steam in combination with a vacuum or partial vacuum, I am enabled to distill even the heavy products of distillation of petroleum and other oils, and at the same time avoid, in a great degree, the decomposition of the oils into non-condensable gas, and the elimination of solid carbon, in the shape of coke or tarry residuum, which is deposited in the bottom of the stills when fire heat is employed. The apparatus employed may be variously constructed and arranged, and the vacuum may be produced by means of an air-pump, water column, or by means of the device hereinafter described.

To enable others skilled in the art to make use of my invention, I will proceed to describe the apparatus which I use for this purpose, referring to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective representation of my apparatus.

Figure 2 is a longitudinal sectional elevation through the line *x x* in fig. 1.

Figure 3 is a transverse sectional elevation through the line *z z* in fig. 1.

836 Figure 4 is a perspective representation of the coil of steam pipe detached from the still.

Figure 5 is a perspective view of the distributor.

Figure 6 is a vertical section through the line *x x*, fig. 5.

Like letters refer to the same parts in all the figures.

In the drawings, A is the foundation or base on which the apparatus is set. B is the still, which may be of any desired shape, set on a raised pedestal, C, to allow of the insertion of the waste pipe K into the bottom of the still, for emptying it when desired, and removing any residuum which may be deposited in the still during the process of distillation. The waste pipe K is opened or closed by a stop-cock, *h*. The still is supplied with oil to be heated through the supply pipe D, which is furnished with a stop-cock, *a*, to open or close the connection of the still with a reservoir of oil, placed in any convenient position, and with which the pipe D is connected. E is a distributor for the superheated steam, consisting of a central pipe and radial arms, *b b*, and a rim composed of segments of an annular pipe, *c c*, attached to the extremities of the radial arms, *b b*. The radial arms *b b* and rim pieces *c c* are perforated with small holes, *d d*, to insure an equal distribution of superheated steam in the interior of the still. From the dome G of the still B, a goose-neck or pipe, H, conducts the products of distillation to the coil of condensing pipes I I, placed in a refrigerator or cold-water tank, J, into which tank a stream of cold water is continually running, an overflow pipe, *g*, being inserted into the side of the tank J, above the level of the pipes I I, so as to keep them submerged in the cold water. The lower end of the coil of condensing pipes I I (farthest from the still) connects with a pipe, N, which opens into a short branch pipe, O, one end of which enters the top of the receiver L and the other end enters the top of the receiver M, the stop-cocks *i* and *j* serving to connect or disconnect either of the receivers L and M with the flow pipe N. By this arrangement the distilled oil runs into one or other of the two receivers L and M, as may be desired. The receivers L and M may be placed side by side on a stand, C′, and the pipes P and Q furnish the cocks *k* and *l*, respectively, serve to draw off the distilled oil from the receivers. Fig. 4 represents a coil of pipe, F, inserted in the still B as shown in fig. 2, so as to be covered by the oil to be distilled. This coil is heated by steam introduced through the

837 cock *e* at one end of the pipe, and passing out when necessary at the blowpipe *f* at the other extremity. The device which I employ for producing a vacuum or partial vacuum in the receivers is shown in figs. 1 and 3. Connecting the two receivers L, and M is a short pipe, S, opening at one end into the receiver L, at the other end into the receiver M, furnished with stop-cocks *o* and *p*, by opening and closing which the vacuum apparatus is connected with one or other of the receivers at pleasure. On the branch pipe S, between the stop-cocks *o* and *p*, is placed a short vertical pipe, *s*, which opens into the pipe S at its lower end. This pipe *s* is surrounded by a hollow globe, *t*, so that the extremity of the pipe *s*, which is slightly tapering upwards, is situated in the cavity of the globe above its centre. On top of the globe *t* is a funnel, R, the lower end of which enters the cavity of the globe *t*, the mouth of the funnel at its lower end (at *v*) flaring outward slightly (as seen in fig. 3) and extending down to and immediately over the top of

the pipe *s*. On one side of the globe *t* is a pipe, T, for admitting live steam into the cavity of the globe, which pipe is furnished with a stop-cock, *p*, for shutting off the steam when the vacuum apparatus is not required to be in operation. When steam is admitted through the pipe T into the vacuum globe *t*, it rushes up through the funnel R, all around the mouth of the upright pipe *s*, with so much force as to draw out the air or gaseous contents of the branch pipe S, and also from whichever of the receivers L or M may be in connection with it. This also produces a vacuum through the condensing pipes, I I, which are connected by the pipe N with the same receiver (L or M) that is in connection with the vacuum apparatus and also in the still B. Air-cocks *m* and *n* are placed one on top of each of the receivers L and M, to admit the atmospheric air into the receivers whenever it is desired to destroy the vacuum for the purpose of checking the distillation or of drawing off the distilled oil from the receivers.

The operation of my apparatus is as follows: When the still is charged with oil to be distilled, and one of the receivers L or M being empty is connected, by opening the cocks, with the branch pipe O and condensing coils I I, steam at from 80° to 120° Fahrenheit is admitted into the coil F, to vaporize the oil in the still B. At the same time the vacuum apparatus is connected with the receiver which is in use, (which is disconnected from the other,) and steam is admitted through the
838 pipe T, which produces a vacuum more or less perfect through the receiver, refrigerator, and still. By means of the withdrawal or reduction of the atmospheric pressure thus effected, the distillation progresses very rapidly, at a low temperature compared to that which would otherwise be required. When all the oil is distilled which will pass over at the heat first employed, I increase the temperature up to about 120 lbs. pressure to the square inch, after which I commence to use superheated steam, by which means I can safely attain any degree of heat which is requisite to distill the heavier oils remaining undistilled at the degree of heat previously employed. The steam may be superheated in any ordinary manner. The coil F may be used for heating the oil with steam up to distilling temperature, and afterwards the steam distributor E, for carrying on the distillation; or either of them alone may be used, as may be preferred. When either of the receivers N or M is filled, its connection with the still and with the vacuum apparatus is shut off, and the other receiver is put in connection with the apparatus, so that the filled receiver may be emptied without stopping the operation. In addition to the advantages already stated as resulting from my improvement, the oil resulting from distillation by the process described is almost entirely devoid of the acrid and unpleasant odor of fire distilled oils, and is almost colorless. The quantity of illuminating oil thus produced from a given amount of crude petroleum is greater by from 12 to 15 per cent. by my process. My apparatus will last much longer than stills to which fire heat is directly applied; there is much less danger of leakage, as the vacuum causes a pressure on the pipes from outside; the frequent stoppage of the works caused by the burning of the stills, where fire is used, is entirely obviated. It is also a great advantage, incident to the dispensing with the use of fire under the stills, that the products of distillation may be safely discharged at a point near to the stills, so that the whole apparatus can be compactly located and be all under the eye of the workman.

Having thus described my improvements, what I claim as my invention, and desire to secure by letters-patent, is—

1. Distilling hydrocarbon oils, such as petroleum and other substances,

under a vacuum, or partial vacuum, by the use of steam, for producing the vaporization of the article to be distilled.

2. The use of superheated steam in combination with the em-
839 ployment of a vacuum, or partial vacuum, for the distillation of petroleum and other hydrocarbon oils, and similar substances.

3. The combination of a steam vacuum apparatus, constructed substantially as hereinbefore described, with the oil-receivers L and M, for the purpose hereinbefore described.

4. The combination of the vacuum apparatus hereinbefore described with the steam pipe or pipes in the interior of the still, and with the still, for the purpose hereinbefore described.

In testimony whereof I, the said Herbert W. C. Tweddle, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

In presence of witnesses:
A. S. NICHOLSON.
GEORGE H. CHRISTY.
2404

840 *Respondents' exhibit No.* 31.

United States Patent-Office, Herbert W. C. Tweddle, of Pittsburg, Pennsylvania, letters-patent No. 72126, dated December 10, 1867. Improvement in distilling hydrocarbon oils.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Herbert W. C. Tweddle, of the city of Pittsburg, in the county of Alleghany, and State of Pennsylvania, have invented a new and useful improvement in distillation of hydrocarbon oils; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is partly a side and partly a sectional elevation of the apparatus I employ in the process of distillation, and

Figure 2 is a rear end view of the same, partly in section.

Like letters of reference indicate like parts in each.

The nature of my invention consists in distilling hydrocarbon oils by causing the oil to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum still, with or without the application of superheated steam, and in securing a continuous and complete distillation of such oils by causing them to flow over the surfaces of a succession of such pipes in different stills, the temperature of the pipes increasing in each successive still, so as to drive off first the more volatile ingredients, and then those less so, and so on, until only the residuum remains; also in the application of such process to the redistillation of fire-distilled, residual, and lubricating oils.

This process of distillation may be carried on in various ways, but the devices which I find most convenient therefor I will proceed to describe, to enable others skilled in the art to make use of it.

841 On any suitable bed or foundation, A, I place two or more stills, B C, or a battery of stills, one, B, somewhat higher than the other, C, usually so that the oil may flow readily from at or near the

bottom of one into the other, as yet to be described. In these stills I preserve a partial or complete vacuum, by the use of an air-pump, or in other known way, and connect them to the condensers B^2 C^2 by the goose-necks B^1 C^1, respectively. In each of the stills B C is a series or coil of pipe, *a*, each pipe of the series or coil passing through the still horizontally, but one being arranged over another in any desirable number of vertical rows, and all connected together by a connection-pipe, *d*, or other equivalent device. Above each vertical row of such pipes *a* is placed a trough, *a'*, which has small perforations in the sides or bottom, as seen in fig. 1, and a serrated edge, *c*, underneath. Below the series or coil *a* is placed a series of perforated pipes, *e*, for admitting superheated steam, such pipes being joined together by a connecting pipe, *d'*.

The petroleum to be distilled, either crude or deprived of the gasto-line or other more volatile ingredients, and either cold or in a heated state, as may be deemed advisable, is admitted through a cock, *b'*, at the side of the still B, into a pipe, *b*, which, running transversely across over the troughs *a'*, discharges through a perforation over each such trough, as shown in fig. 2, the oil in such perforated and serrated troughs *a'*. Through the perforations in each trough *a'* the oil runs down, gathers on the points of the serrated edges *c*, whence it falls on to the steam-pipes *a*, dropping or running from pipe to pipe, and passing in a thin film over the surfaces of such pipes. A current of dry or superheated steam, passing in at the valves *x x*, keeps such pipes *a* heated to a high temperature. Consequently the drops or streams of oil, coming in contact with and passing over them, are subjected to the action of a heated surface relatively large, which causes it to volatilize with great rapidity, the more so as the pressure of the atmosphere is already removed from the inside of the still by the air-pump, as hereinbefore stated. Fluids in motion, also, it is well known, vaporize more rapidly than fluids at rest, so that by causing the oil to flow over heated surfaces in a vacuum, I secured an exceedingly rapid evaporation. I also facilitate this process by bringing jets of superheated steam from the pipes *e* in contact with the oil while flowing over the surfaces of the pipes *a*. A serrated edge may be placed under each such pipe *a*, to secure a more
842 even distribution of the oil in its flow from pipe to pipe. Steam is admitted to the pipes *e* through the valves x^1 x^1, and the water of condensation drawn off from the pipes *a* and *e* by the cocks x^2 x^2. By the use of these devices, the lighter or more volatile oils are driven off in the first still, B, in the form of vapor, which, being carried over the goose-neck B^1 to the condenser B^2, is there condensed, as presently to be described. Such of the heavier oils as are not thus vaporized in the first still, B, fall to the bottom of the still, whence by a pipe, *f*, they are conducted into the next still, C. There they are discharged into perforated and serrated troughs, *a'*, flow on to and over pipes *a*, and other volatile ingredients are driven off in vaporous form by an increased degree of heat received therefrom, and from the superheated steam which escapes from the jet-holes, in the pipes *e*, in the manner already described. The residuum, with the oils not yet volatilized, if any, falls to the bottom of the still C, whence it is conducted to another still and similarly treated, or by a pipe, *f'*, is discharged into a receiver, D, in which a vacuum is also preserved. From this it is drawn off by a cock, *g*, at pleasure. A pipe, *h*, connects the receiver D with the still C, for convenience in securing a vacuum in the former, and for the purpose of conducting over any vapors which may arise from the residual matter in such receiver.

The steam used in this process may be admitted into the pipes *a* and *e* of each still separately, or it may be first admitted into the pipes *a* and *e* of the last and lowest of such stills, and conducted thence by pipes *i i'* into the pipes *a e* of the next still, and so on till the last or highest still is reached. In this way I apply the steam when hottest to volatilizing the heavier oils, which of course require for that purpose the greater degree of heat; and as the temperature of the steam is reduced in its passage from still to still, I apply it at a lower temperature to driving off the lighter oils in each higher still; or, in other words, I secure a continuous and complete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier ingredients by a higher degree of heat, passing the residual oil for that purpose from still to still, so as to subject it to a constantly-increasing temperature in the successive stills, till only the residuum remains. Superheated steam may, if preferred or found necessary, be used in the pipes *a* as well as in the pipes *e*. By the use of this
843 process I render unnecessary the application of fire or fire-heat directly to the oil at any state of the distillation, whereby I avoid all possibility of a fire or an explosion, which are the chief sources of danger in the distillation of hyrocarbon oils.

As already stated, the vapors of volatilization in the still B pass by the goose-neck B^2 to the condenser B^1, which is a combination of a surface and shower condenser.

The condensing apparatus is the same for all the stills, and consists of a condensing-chamber, C^2, with cold-water chambers *m m'* at either end, connected together by pipes *n*. The upper chamber is perforated as at *o*, so as to discharge jets of cold water into the condensing-chamber C^2, to condense the oily vapors. Cold water is passed through the pipes *n* for the same purpose. Water is admitted and drawn off by the cocks *s s*. The condensed oil is drawn off at the cock *s'*, with the condensed water, if there be any, and discharged into a tank or other receptacle through an air-pump or otherwise. The condensers may be so constructed that the pipes *n* shall run horizontally through the condensing-chamber, if so preferred.

It is not absolutely necessary that one still should be higher than another, since by creating a more complete vacuum in the second still than in the first, and so on in each successive still, the residual or unvaporized oil in the bottom of each still may be forced into the next at the same or a higher level.

The advantages of this process of distillation are, among others, first, dispensing entirely with the application to the oil of fire or a fire-heat, as already stated; second, a more rapid vaporization of the oil; third, collecting the vapors of the lighter and heavier oils and condensing them in separate receivers, whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients which render them dangerous in use at the temperatures to which, in such use, they are necessarily raised; fourth, a continuous and more complete distillation of the oil that can be secured by the ordinary process; fifth, a cheaper process of distillation; and sixth, the production of a better article.

As a further part of my improved process, I take oil produced by distilling by fire (the process ordinarily in use) and redistill it in vacuo substantially as above described. Unrefined fire-distilled oil has a disagreeable odor and a bad color, to remove which the oil is gener-
844 ally treated with acids, alkalies, etc. My process of distillation obviates the necessity of refining the oil, with a consequent sav-

ing of time, trouble, and expense, and also produces an article superior in quality to the common fire-distilled refined oils. I also apply my improved process to the distillation of the residual and lubricating oils produced by fire-distillation, with the same benefits as above set forth.

In carrying on the process of distillation above set forth, I do not limit myself to the particular devices described; but

What I claim as my invention, and desire to secure by letters-patent, is—

1. In distilling hydrocarbon oils, vaporizing the oil by causing it to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum-still, with or without the application of superheated steam, substantially as above described.

2. The application of the process of distillation hereinbefore described to the redistillation of fire-distilled oils, for the purpose of producing an oil similar to the refined oil of commerce, substantially as above set forth.

3. Securing a continuous and complete distillation of hydrocarbon oils, by causing the oil to flow over the surfaces of a succession of heated pipes in different vacuum-stills, the temperature of such pipes increasing in each successive still, so as to drive off at first more volatile ingredients, and then those less so, and so on till only the residuum remains, substantially as hereinbefore described.

In testimony whereof I, the said Herbert W. C. Tweddle, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

Witnesses:
A. S. NICHOLSON,
G. H. CHRISTY.

845 *Defendants' exhibit No. 70, I. H. B.*

The United States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file wrapper in the matter of the letters patent granted to Herbert W. C. Tweddle, dated December 10, 1867, No. 72126, for "improvement in distilling hydrocarbon oils."

In testimony whereof I, J. M. Thacher, Acting Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this twelfth day of June, in the year of our Lord one thousand eight hundred and seventy-three, and of the Independence of the United States the ninety-seventh.

J. M. THACHER,
Acting Commissioner.

1867.
No. 72126.

Herbert W. C. Tweddle, of Pittsburg, county of Allegheny, State of Pennsylvania.—Distillation of hydrocarbon oils.

Received November 22, 1867.
Petition, " " "
Affidavit, " " "
Specification, " " "
1 Drawing, " " "
Model in case A.
1 Cert. dep. $15, November 22, 1867.
Cash.

Add'l fee cert.
1 Add'l fee cash, $20, November 27, 1867.
Examined November 26, 1867, B. S. Hedrick.
2 Issue, A. M. Stout, November 29, 1867.
3 Patented December 10, 1867.
Recorded vol. , page .
Circular.

BAKEWELL & CHRISTY,
Pittsburg, Pa.

846 *Stipulation.*

All objections which might be taken by complainant to the admissibility of any testimony introduced by respondents because introduced before the amendments of the answers, or either of them, are hereby waived.

CHAUNCEY SMITH,
For Complainant.

847 The following is a copy of the opinion, in accordance with which the decree was entered February 13th, 1874, dismissing the bill of complaint in the cause.

Circuit court of the United States, district of Massachusetts, in equity.

JOSHUA MERRILL
v.
DAVID M. YEOMANS ET AL.

Opinion of the court.—Feb. 13, 1874.

SHEPLEY, *J.:*

The invention of the complainant relates to the manufacture, from heavy hydrocarbon oils, possessing the characteristic odors of such oils, by a process of treatment described in the specification in his patent, of deodorized heavy hydrocarbon oils, free from such characteristic odors, and having only a slight smell, like fatty oil, and suitable for lubricating and other purposes.

The most important and intricate questions presented at the hearing of the case relate to the construction of the first claim in the patent. Considered in the broader view which courts take of the construction of claims, by considering them in connection with the specification, and the discovery and invention therein described, the question presented is, what is really the subject of the complainant's patent? Is it for a new article of manufacture, or for a new process of manufacturing? Is it, in the words of the statute, for "a new and useful art," or for "a new and useful manufacture?" It is contended on the part of the complainant that the patent secures to Merrill his product, and products substantially the equivalent of his, by whatever process produced. The respondents, on the other hand, contend that the patent is only for a process. Another construction, which we shall have occasion to consider hereafter, may be adverted to here, that the patent is for the described product of a specially described process. The questions
848 of construction of the claims are attended with more difficulty from the fact that the patentee, in stating his invention and specifying his process, and making his formal claim, uses the word "manu-

facture" in its two different meanings, signifying respectively the operation of making and the thing made.

To arrive at the true construction of the claim, we must first understand the nature and properties of "the heavy hydrocarbon oils," which are the subject of the described treatment; next, the described treatment, process, or art, and finally "the deodorized heavy hydrocarbon oils," the described product of the treatment. This renders necessary a hasty glance at the history and state of the art prior to the invention of the complainant.

These oils are called hydrocarbons because they are composed of hydrogen and carbon, and do not, like most animal and vegetable oils, contain oxygen. They are the product of distillation of bituminous coals and shales, and of natural asphaltum or bitumen. The principal source of supply at the present time, however, is from the petroleum wells, the product of which is used either in its natural state or as converted into a variety of articles by the process of distillation. By distillation a great variety of products can be obtained by the same process from coal, coal-tar, asphaltum, and petroleum. The distillation of petroleum was at first practised only for the purpose of refining it by separating it from foreign matters, and separating from it some of the combined carbon, too large a proportion of carbon causing it to generate too much smoke, and rendering it unfit for use in lamps as an illuminating oil. It soon became known that in distillation petroleum separated into hydrocarbons of different gravities. Ordinary distillation separated the substance from fixed bodies held in solution or suspension in it, and separated the more volatile bodies from those of less volatility. By destructive distillation of petroleum, the character of the substances was changed in like manner as gas is produced by the destructive distillation of coal.

In the process of distillation, petroleum separates into hydrocarbon fluids of different gravities. The lightest fluids come over and are condensed first, and they increase in gravity as the distillation proceeds. The lighter oils come over more readily and with less heat. The heavier oils require a higher degree of heat to vaporize them. During
849 the process of distillation, by changing from time to time the receiving vessel into which the distillate runs from the condenser, the distillate is separated into the various products having different gravities. This is termed fractional distillation. By continually changing the receiver from time to time, fluids of any desired gravity may be obtained from the highest to the lowest which petroleum will yield under treatment. An arbitrary division of the products is made in practice according to the commercial uses of the products. All the fluid which first runs from the still, until it falls to a gravity of about 60° Beaumé, is classed as benzole or naphtha. All in the next grade, between 60° and about 38° or 40° Beaumé, is known as "burning oil" or "refined oil," and more popularly known as "kerosene oil," and is used principally for illuminating purposes. All the distillate below 38° or 40° Beaumé is known as paraffine oil, or lubricating oil, and this is the product of distillation which Merrill refers to in his specification as "heavy hydrocarbon oil." The language of the specification is, "My invention relates to the heavy hydrocarbon oils, which have heretofore been produced by distilling crude petroleum, or the crude oils obtained from the distillation of bituminous coals, bituminous shales, bituminous schists, asphaltum, and other substances producing hydrocarbon oils by distillation. * * * These oils are well known to the trade, and distinguished from the lighter burning oils and naph-

thas by the term 'heavy oils,' their specific gravity varying greatly between the asphaltum oils and paraffine oils."

These heavy hydrocarbon oils thus produced had a persistent disagreeable smell, which made them offensive and undesirable for use in close, warm rooms, as in woollen manufactories. "Attempts had been made to remove the smell by filtration, but with partial success." It had been the practice to treat such oils with acids and alkalies for the purpose of removing the peculiar offensive odor. This resulted in improving the character of the odor, but without wholly removing the persistent disagreeable smell. For several years before the date of Merrill's invention, the progress of improved modes of treatment of paraffine oils had been so great that heavy hydrocarbon oils for lubricating uses had been produced and sold in large quantities, substantially, although not entirely, free from the peculiar odor of petroleum distillates.

William Atwood, a witness on the part of the complainant, who
850 has been connected with this manufacture from its inception to this day, and who is probably as familiar with the history of the art and the properties of the different hydrocarbons as any manufacturing chemist in this country, testifies in relation to the lubricating oils manufactured prior to the date of the Merrill invention by the Portland Kerosene Oil Company, and known, in the evidence in this record, as the Portland oils. His testimony is in substance that the Portland oil, compared with the oil manufactured by the Downer Company under Merrill's patent, is "as good as a lubricating oil, but not for mixing with other oils, where it is desired that its own peculiar smell shall not appear. * * * There still remained the odor of the volatile oils which were always present. It was certainly desirable to remove any odor arising from any source." He also describes the odor of the Merrill oil as "a different odor" from the odor of the Portland oil, "being less tenacious, or, in other words, one can be completely covered up with a smaller amount of any other odor than the other."

As the Portland oils and those substantially like them, sold by the Downer Company before the date of Merrill's invention, were the best of the heavy hydrocarbons sold as lubricating oils at that time, it is sufficient to refer to them as showing the state of the art at that time, without more particularly adverting to the Maysville and other oils, which also had been previously manufactured and sold, and which the witnesses have particularly described. It is also contended in behalf of the respondents that the "neutral topaz oil," like that sold by the defendants, had been manufactured by Dr. Tweddle, of Pittsburgh, before the date of Merrill's invention. I do not find, after careful comparison of the testimony in the case, sufficient evidence to satisfy me that such was the fact. On the contrary, I am satisfied that Merrill was the first and original inventor of the process described by him, and I therefore pass to the consideration of the second step in the inquiry as appertaining to his process, and the product of his process, and the invention claimed and secured by his patent. The first step in this inquiry has been to ascertain what was the material to be operated upon. This we have found to be a heavy hydrocarbon oil, the product of distillation, objectionable for use as a lubricator by reason of those offensive odors peculiar to petroleum distillates. These offensive odors were due to the presence of the more volatile oils. The heavy hydrocarbon
851 oils were generally sold as lubricators, to be mixed by the purchasers with sperm oil or other fatty oils. They were also mixed with such oils by the manufacturers and dealers, and the mixed oils

sold to the consumers for lubricators. Before the introduction of the Merrill oil, although the producers of the heavy hydrocarbon lubricators had succeeded in so far freeing them from the volatile compounds and the lighter and thinner oils as to put on the market and sell in very large quantities an article satisfactory to the consumers in relation to its lubricating qualities, and substantially free from the peculiar offensive odors, yet this result was attained by a sacrifice of quantity to quality in the manufacture, and was only proximately the desired result; for there still remained some of the odor of the volatile oils. This peculiar odor was so persistent that, when mixed with other oils in whatever proportions, it was the predominant odor and pervaded the whole mass.

The next step to be taken in the path of inventive art as applied to the manufacture of paraffine or lubricating oils was to eliminate the peculiar characteristic odor of the petroleum distillates, and also to increase the proportion of deodorized heavy hydrocarbon oil produced from a given quantity of crude oils. This brings us to the second step of the inquiry—Merrill's process.

After stating that his "invention relates to the heavy hydrocarbon oils which have been heretofore produced by distilling crude petroleum or the crude oils obtained from the distillation of bituminous coals, bituminous shales, bituminous schists, asphaltum, and other substances producing hydrocarbon oils by distillation," and after adverting to the various modes of treatment by acids and alkalies and by filtration, which had been resorted to, with only partial success, to remove the persistent disagreeable odor peculiar to these distillates, he describes his process as follows: "To make heavy hydrocarbon oils free from the characteristic unpleasant odors of heavy hydrocarbon oils, I take the heavy oils which have been separated from the lighter oils and from mechanical impurities by distillation, and after chilling and expressing the solid paraffine, when such operation is necessary, place them in a still heated by a fire underneath, and slowly and gradually raise the temperature until from ten to thirty per cent. of the contents of the still are distilled over, when the still is cooled down and the remaining contents removed.

852 The matters which go over to the condenser have a very foul, offensive, and disgusting odor, but the oil remaining in the still, if the operation has been properly conducted, is free from the characteristic offensive odor of hydrocarbon oils, and has no smell except a slight odor similar to fatty oils. It can be mixed in all proportions with sperm, lard, fish oils, and vegetable oils, and is so neutral in its character that it takes the odor of the oil that it is mixed with."

He then goes on to describe, as a separate and distinct invention, the introduction of superheated steam within the still, whereby he claims the process will be facilitated, and oil of lighter color produced. This is the subject of the second claim in the patent. As no question arises in this case out of any alleged infringement of the claim relating to this portion of the alleged invention, no further reference will be made to it. After describing his apparatus, and the mode of using it for the introduction of superheated steam within the still, he continues: "I do not wish to confine my invention to its use in combination with the fire, because I can accomplish the same result by fire heat alone applied to the still, or by any known mode of heating the still which will heat the oil sufficiently to distil over the portions of the oil necessary to be removed." This, then, is his process: taking the heavy hydrocarbon oils the product of distillation, from which the lighter oils and mechanical impurities have been separated by distillation, (and the paraffine, when

necessary, also separated by the process of chilling and expressing,) he distils from them the volatile matters from which the objectionable odors arise, and at the same time prevents new formations of such matters by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil. After distilling off from twenty to thirty per cent., as the case may be, of volatile matters, the oil is left to cool in the still, and is then drawn off into tanks for sale and use.

Third, the product of Merrill's process.

This is well and aptly described in the words of the specification—heavy hydrocarbon oil, "so completely divested of its fetid and pungent odors, having only a slight smell like a fatty oil, and so oily, as to be greatly improved and increased in value as a lubricating oil, or for any purposes for which it may be used, either alone or mixed with other oils."

853 Having determined the scope of Merrill's invention, we are better able to determine what is within the scope of his claim.

The first claim in his patent is as follows:

"I claim the above-described new manufacture of deodorized heavy hydrocarbon oils, suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from heavy hydrocarbons, by treating them substantially as hereinbefore described."

If we were to omit from this claim the last seven words, "by treating them substantially as hereinbefore described," there would be little doubt that the claim was broadly for a new article of manufacture, without limitation as to the mode by which it might be produced. It is claimed that the use of this last phrase in the claim, in connection with the words in the first part of the claim, render the claim, when properly construed, a claim for the described process alone. Substantially, the argument is that "a manufacture" of oils, "by treating them substantially as hereinbefore described," is a claim for the described process, rather than for the product.

A patentee who has invented a new process in the arts, whereby an article of manufacture is produced, new in kind, and not before known, may separately claim and patent both the art and the manufacture. He cannot properly combine them in one claim. Differing in that respect from the English law, which allows a patent for "any manner of new manufactures"—a term which includes process and product—our law distinguishes between a patent for an art and a patent for a manufacture. "No doubt," says Mr. Justice Clifford, in Goodyear v. The Providence Rubber Co., "can be entertained that a new product or manufacture, and a new process or method of producing the new article, are the proper subjects of separate and distinct claims in an original patent." Sometimes an old process produces a new product. If the thing produced be new, in and of itself, it is patentable as a new manufacture. If it be capable of being produced by various different processes, as, for instance, by hand, by the use of hand-tools, or by automatic or other machines, yet, when the product is independent of the process, the patent is infringed by the unlicensed manufacture of the new product by any mode of manufacture, the process of manufacture being wholly unimportant.

854 In other instances, however, not only does a new process produce a new product, but the process is inseparable from the product, and inheres in it after it is made, so that, upon inspection of the product it is manifest that the process must have been employed.

Whenever we see the new manufacture "vulcanite," we know this product was made by the process of subjecting a plastic compound of rubber and sulphur to heat, whereby the chemical change was effected which characterizes the vulcanite.

It is competent, therefore, for a patentee, under the appropriate and fitting conditions appertaining to his invention, to claim broadly the new product, however made, or to claim the new product when made by a described process. This, it appears to us, is what Merrill has claimed, a heavy hydrocarbon oil having the characteristics described in the patent, and produced by the treating the oils in the manner described in the patent. He made his claim as if he believed that his oil could only be made by his process; and if such was his belief, the evidence has not fully demonstrated to our satisfaction that he was not justified in that belief. The construction we have given to the claim is the only one which appears to us to be admissible, and the only one consistent with the language used by the patentee, and one which most effectually, probably, secures to him the product of his invention. The thing patented and covered by the first claim in the patent is, consequently, a heavy hydrocarbon oil, produced from heavy hydrocarbon oils, themselves the product of distillation, and having the offensive odors peculiar to petroleum distillates, such patented heavy hydrocarbon oil being so far deodorized as to be free from the characteristic odors of heavy hydrocarbon oils, and having a slight smell like fatty oil, suitable for lubricating and other purposes, and the product or result of the treatment described in the patent.

The respondents are charged with an infringement of this first claim in the letters-patent No. 90284 to Joshua Merrill, the complainant, dated May 18, 1869.

The evidence of infringement rests in the proof that the defendants have purchased, used, and sold in the market quantities of heavy hydrocarbon oils known as neutral topaz oils, being the product of a manufacture by Herbert W. C. Tweddle, of Pittsburgh, according to the
855 process described in his patent, No. 99975, dated Feb. 15, 1870.

This neutral topaz oil is abundantly proved to possess many characteristic properties in common with those peculiar to Merrill's oil, and which distinguished Merrill's oil from the lubricating paraffine oils which had preceded it. The two oils have substantially the same density and odor, the same amount of lubricating quality, the same freedom from the offensive odors of petroleum distillates. In both, the boiling point was from one hundred and fifty to two hundred degrees higher temperature than the boiling point of the best of the other hydrocarbon heavy oils. Whatever presumption of fact might arise, in the absence of other proof to the contrary, that the processes must be substantially the same because the results are so similar, we are not left in doubt, in this case, as to the process of making the "neutral topaz oil." It is clear that the process is essentially different from that described in Merrill's patent. The very essence of Merrill's invention was the elimination of offensive odors existing in distillates, the product of a destructive distillation. It was a deodorizing process, consisting in the removal, by distillation, of the light offensive oils produced in the oil by previous distillations, leaving a sweet residuum in the still. This product was a deodorized oil, an oil disinfected, an oil described by him as "completely divested of its fetid and pungent odors." Tweddle does not make his oil from a distillate made offensive by the presence of the products of distillation, but directly from crude petroleum. His process is not a deodorizing or disinfecting process to remove the odorous bodies that had been

formed by or existed after distillation. It is designed to so conduct the distillation as to leave the distillate of crude petroleum free from those odorous bodies. Tweddle's has been well described as a process of prevention, while Merrill's is one of cure. In the two processes, Merrill's deodorized oil is a residuum left in the still; Tweddle's neutral topaz oil is a distillate which passes over and is condensed, and falls into the receiver. Tweddle's process is conducted in vacuo; Merrill's under atmospheric pressure. Other differences are apparent, upon examination of the different processes, as described in the respective patents, and as described by the expert witnesses. Sufficient has already been said to show that the differences in the two processes are so radical that Tweddle's neutral topaz oil cannot, with justice, be
856 claimed to be a deodorized heavy hydrocarbon oil manufactured from heavy hydrocarbon oils by treating them substantially as described in Merrill's patent. Therefore, the use and sale of it by the defendants was not an infringement of the first claim in the Merrill patent.

Bill dismissed.

857, 858 UNITED STATES OF AMERICA,
Massachusetts District, ss:

I, John G. Stetson, clerk of the circuit court of the United States for the first circuit and district of Massachusetts, certify that the foregoing is a true copy of the record and of all proceedings in the cause of Joshua Merrill v. David M. Yeomans et al., in this court determined.

In testimony whereof I have hereunto subscribed my name and affixed the seal of said circuit court, at Boston, in said district, this twelfth day of October, in the year of our Lord one thousand eight hundred and seventy-four, and of the Independence of the United States the ninety-ninth.

[SEAL.] JOHN G. STETSON, *Clerk.*

(Indorsement on cover:) No. 209. Joshua Merrill, appellant, vs. David M. Yeomans and Daniel J. Goss, as D. M. Yeomans & Goss. Massachusetts C. C. U. S. Filed 23rd October, 1874.

4—568

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1876.

JOSHUA MERRILL, *Appellant*,

vs.

DAVID M. YEOMANS ET AL., *Appellees*.

No. 209.

APPELLANT'S BRIEF.

CHAUNCEY SMITH,
CHARLES M. REED,
of Counsel.

Supreme Court of the United States.

No. 209. OCTOBER TERM, 1876.

IN EQUITY.

JOSHUA MERRILL, APPELLANT,

v.

DAVID M. YEOMANS ET AL.

APPELLANT'S BRIEF.

I.

STATEMENT OF THE PLEADINGS.

The bill in this case was filed March 25, 1870. It alleges that the complainant was the original and first inventor of "a new and useful improved manufacture of deodorized heavy hydrocarbon oils," for which Letters Patent of the United States were granted him, dated May 18, 1869, and that the defendants, in violation of said patent and of the rights of the complainant, have sold and used large quantities of said manufacture, but how much the complainant is unable to state. The bill then asks for a disclosure by the defendants of the quantity of deodorized heavy hydrocarbon oil sold or used by them since the date of the patent, and for an explanation "wherein the hydrocarbon oil sold by them under the name and designation of 'Neutral Topaz Oil' differs from the manufacture patented to the orator as aforesaid, if at all." The bill further prays for an account and for an injunction.

The answer was filed on the 24th of May, 1870. It admits the grant of the patent as alleged in the bill, but denies that it was lawfully issued, or that the improvement had not been in public use or

on sale with the consent of the patentee more than two years before the application for the patent, or that Merrill was the original and first inventor of the deodorized heavy hydrocarbon oil described in the patent, or that he obtained any exclusive right or liberty by virtue of said patent.

The answer alleges that the said "improved manufacture of deodorized heavy hydrocarbon oils" was known and used by sundry parties named before its invention by Merrill, and that it was in public use and on sale with his consent and allowance more than two years before his application for a patent.

In response to the inquiry of the bill as to the difference, if any, between the deodorized heavy hydrocarbon oil patented to the complainant and the Neutral Topaz Oil sold by the defendants the answer admits, —

"That the defendants have sold at said Boston oil known as 'Neutral Topaz Oil,' purchased by them from the manufacturers thereof, the 'Eclipse Petroleum Refinery,' of Pittsburg, Pennsylvania; but, upon information and belief, they deny that it is substantially such a deodorized heavy hydrocarbon oil as that described in the said Letters Patent, or that it is produced by substantially the same process as that therein described, but how the said oil and the said process differ from the oil and the process described in the said letters patent, they are not informed and cannot answer.

The answer also denies the alleged infringement.

The answer was filed on the 24th of May, 1870, two months after the bill was filed, and on the 30th of May the plaintiff filed his replication. On the 3d of October following, an amended answer was filed, and allowed without further replication, in which it was alleged that the patented invention was known and used, before its invention by Merrill, by sundry persons not named in the original answer, and that it was described and patented in sundry English patents.

Taking the original answer in connection with this amendment, and the allegation of prior knowledge and use by others before Merrill made the invention, the answer stands as follows: —

"These defendants say, on information and belief, that the said 'improved manufacture of deodorized heavy hydrocarbon oils,' described in said letters patent, or a substantial or material part thereof claimed in said letters patent as new, was,

before the alleged invention thereof by the said Merrill, known to and used by George M. Gallop, of Salem, Massachusetts, at said Salem, and also at Brooklyn, New York; Eben Seacomb, of Boston, Massachusetts, at said Salem; and Edward S. Thayer, of said Salem, at said Salem; and was described and patented in the following English patents, that is to say: Letters Patent granted to Warren de la Rue, dated September 4, 1855, sealed November 23, 1855, inrolled February 28, 1856; Letters Patent granted to William de la Rue, dated July 25, 1853, sealed October 6, 1853, inrolled January 18, 1854; Letters Patent granted to William Kilgour, dated January 22, 1855, sealed March 20, 1855, inrolled July 21, 1855."

Upon the issue thus raised, both parties proceeded to take their proofs, but the defendants, instead of confining their proofs of prior invention to the persons and patents as then set forth in their answers, offered a large amount of evidence to prove that one Herbert W. C. Tweddle, who was not named in the original answer or in the first amendment, but who was in fact the proprietor of the Eclipse Petroleum Refinery mentioned in the original answer, was himself the first inventor of the invention patented in Merrill's patent. This evidence was taken without objection from the complainant, and evidence in rebuttal was taken on his behalf in the same manner as if the answer had contained the proper allegation and on the 13th of November, 1871, the complainant consented to the filing of another amendment of the answer, found on page 4 of the printed record, in which it is alleged that the invention described as new in Merrill's patent was described and patented in a patent granted to the said Tweddle, Feb. 4, 1862, and in its reissue dated Nov. 26, 1866 and also that the invention was known to and used by the said Tweddle at Sharpsburg Bridge, near Pittsburg, before its invention by Merrill. It also alleges that the invention, before it was made by Merrill, was known and used by William Atwood, of and at Cape Elizabeth, in Maine.

This amendment also contains an addition to the third clause of the original answer, by which it is alleged that the Neutral Topaz Oil sold by the defendants is manufactured by said Tweddle according to a process invented by himself *long before* the alleged invention by the complainant; and that it was fully described and patented in his said patent of Feb. 4, 1862, and its reissue dated Nov. 27, 1866, and also in a patent granted to him Dec. 10, 1867.

This amendment contains also an allegation that the specification of the patent does not contain the whole truth, and that it contains more than is necessary to produce the described effect, etc.

The issues raised upon these pleadings relate first to the validity of the patent, mainly as against the alleged inventions of others before Merrill, and as to this, principally, as against Tweddle himself; and second, to infringement.

Grounds of Appeal.

The appellant contends that the decree of the Circuit Court dismissing his bill was erroneous, and should be reversed.

He further contends that the Honorable Judge of the Circuit Court was in error in so construing the appellant's patent as to limit it to a heavy hydrocarbon oil having the characteristics described in the patent, when, and only when, produced by the treating the oils in the manner described in the patent.

Also, that the said judge was in error in the finding stated in his opinion, that the process used by the appellee in the manufacture of his oil was essentially different from that described in appellant's patent, whereas the evidence contained in the record shows that the two processes were substantially the same.

Also, that the said judge was in error in holding that the process of the appellant was a process for removing the light odorous oils formed in the distillation of heavy hydrocarbon oils, while the appellee's process was one for preventing the formation of such light odorous oils during the distillation, — the one being a process of prevention, the other of cure, — whereas it appears on the face of the appellant's patent that his process included such prevention, and was not limited to the mere removal of light odorous oils, already formed.

And it was shown that defendants' process also included the removal of such light-odorous oils.

II.

Construction of the Patent.

Before considering the facts of the case we desire briefly to call the attention of the Court to the subject matter of the patent as shown on the face of the patent itself.

The patent recites that Merrill has alleged that he has invented a new and useful improved manufacture of deodorized heavy hydrocarbon oils, and among other things that he believes that he is the original and first inventor of the *said invention*, *i. e.*, of the improved manufacture of deodorized heavy hydrocarbon oils. The grant in the patent is the exclusive right to make, use and vend to others to be used the "*said invention*," a description whereof is given in the annexed schedule.

The inquiry then is, What is the said invention embraced in or described by the terms, "improved manufacture of heavy hydrocarbon oils"?

The plaintiff and appellant claims that it is a new oil described in the specification.

The defendant claimed in the Court below that it is the process described by which the oil described is produced.

The Court below seems to have held that it is the new oil described, *when produced and only when produced by the process described*, and from the oils known as heavy hydrocarbon oils in the market at that time.

However ambiguous the word "manufacture" may be in the English law, it is clear that in the Act of Congress it is used to designate

an *article of manufacture* as distinguished from *the art or process* of making it.

Whenever, therefore, the word is used in Letters Patent of the United States, there is a strong presumption that it is used in the same sense.

That this is the sense in which the term "improved manufacture" is employed in Merrill's patent, is apparent from the language both of the patent and the specification.

Passing to the specification, to which we are referred by the patent for a description of the "*said invention*," granted under the terms "improved manufacture of deodorized heavy hydrocarbon oil," we are met at the outset with this statement of what the patentee has invented, in these words: "Be it known that I, Joshua Merrill, of the city of Boston," etc., "have invented a new and *improved manufacture of deodorized heavy hydrocarbon oils*, suitable for lubricating oils or for curriers' use, and I do hereby declare that the following is a full and correct description *thereof*, and of the mode of manufacture."

Here we have the invention stated in the same terms as in the patent itself, and an explicit statement that a description "*thereof*" is to follow, together with a description, in addition, of the "*mode of manufacture*."

No language could show more clearly that the terms "*improved manufacture of deodorized heavy hydrocarbon oils*" applied to the invention, do not relate to the *mode* or *process* of manufacture.

Pursuing the specification further, we find two distinct things described: —

First. An oil different from any oil known before, having peculiar and well-defined properties and uses.

Second. The way or manner in which such oil is produced.

This way or manner is almost or quite invariably spoken of as a *process*.

Twice only is the term *manufacture* used in the body of the specification. In one case the language is, "It is not practicable to specify particularly the specific gravity of the heavy oils used in my new manufacture."

Here the term is used in the same sense as in the opening paragraph, to designate the article. The heavy oils formed the basis of the new oil and might well be said to be used in it, as a mechanic might speak of the steel used in a new file or drill.

In the other passage the patentee, after describing a peculiar form of distilling apparatus which he has invented, says, "In carrying on my new manufacture of deodorizing heavy oils with this apparatus, etc.

Here the word "manufacture" is apparently inadvertently used in reference to the process.

It will be observed that this passage occurs in the latter part of the specification, in the description of the manner of using a particular form of apparatus, and that in the general description of the method of producing the new oil found in the previous portions of the specification the word "process" is invariably and repeatedly used.

We submit that this incidental use of the term "manufacture" is entitled to no weight in controlling the meaning of the expression as used in the opening paragraph, where the attention of the draftsman was especially directed to the distinction between the process and the product.

The term "process" is used by the patentee at least eight times in speaking of the *mode of manufacture*.

He first speaks of old modes of treating oils to remove their offensive odors, and refers to them as "*such processes*."

After describing the way in which he treats heavy oils and the new oil which he obtains, he says, "The *process* may be conducted in a common still," etc. "When operating by *this process* upon the paraffine heavy oils," etc., "I do not assume to know the reason why *the above described process* produces heavy oils free from the characteristic odors of hydrocarbon oils." "In carrying on *my process* I use the heavy hydrocarbon oils for sale in the market, whether they have been treated by chemicals or not, the *result of the process* in either case being the same." Again, near the end of the specification, he says, "I prefer to use superheated steam in working *the above described process*," etc. Speaking of the use of fire heat alone, he says, "I am obliged to conduct *the process* at higher temperatures," etc. Again he says, "My invention will be used, if the *above mentioned process* be worked to produce the deodorized heavy oils above described," etc.

As the patentee was bound to describe a method of making his new oil, and as the method of making it, as well as the oil itself, was new, it was natural and proper for him to speak of the process as "*my* process" and "*my* invention"; and no argument can be drawn from the use of these expressions to support the theory that he intended to patent the process or method referred to.

It is certain that he did not patent both the process and the product, and these expressions are all perfectly consistent with his statement at the opening of the specification that he has "invented a new and improved manufacture of deodorized heavy hydrocarbon oils," and that the specification contains "a full and correct description *thereof, and* of the mode of manufacture."

Finally, at the close of the specification, the patentee claims "the above described new manufacture of deodorized heavy hydrocarbon oils suitable for lubricating and other purposes," etc., using precisely the same collocation of words which he uses in describing his invention in the patent and in the opening of the specification, and which he there carefully applies to the *new oil* as distinguished from the

mode of manufacture. The presumption certainly is that they are used with the same meaning in the claim. The claim, after referring to some of the characteristics of the oil, closes with the words, "from heavy hydrocarbon oils, by treating them substantially as hereinbefore described."

The defendant contends that these words show that the word "manufacture" in the claim is used in the sense of "process" or mode of manufacture. Such is not their necessary or even natural effect. They are fully satisfied by considering them as further describing the article of manufacture claimed, by reference to the manner in which it is made.

Any different construction involves the improbability of supposing that the patentee, after asking for a patent for "a new and useful manufacture of deodorized heavy hydrocarbon oils," and after once in his specification expressly describing that manufacture as a new oil, and distinguishing the description thereof from that of the mode of manufacture, afterwards in the same instrument uses precisely the same form of words for the purpose of specifying and claiming as the subject of his patent, not the article, which he commences his specification by saying is his invention, but the mode of making it, which he there mentions as a separate subject for description.

Admitting the patent to be for the new article of manufacture, the Court below held that the effect of the latter part of the claim was to limit it to the new oil when made by the described process, reading the claim as though it were written, "The above described new manufacture of deodorized heavy hydrocarbon oils . . . *when made, and only when made*, from heavy hydrocarbon oils by treating them substantially as hereinbefore described."

Such we submit is not the true construction.

The language used is equally capable of being construed not as a limitation of the claim for the new article of manufacture, but as a further description of it.

It is very difficult to express in words the exact differences between oils which physical examination shows to be widely different from each other.

The difficulty is still greater in the present case, as both the new oil and the old hydrocarbon oils are made from the same material, petroleum.

Accordingly, after specifying some of the uses of the new oil and calling attention to its freedom from the characteristic odors of heavy hydrocarbon oils and its having a slight smell like fatty oil, the patentee, in order to make the description more definite, if possible, refers to the described process of manufacture as furnishing the oil to be taken as the standard of comparison.

The appellant, therefore, contends that the claim should be read as though written, "The above described new manufacture of deodorized heavy hydrocarbon oils, suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, *such as are made* from heavy hydrocarbon oils by treating them substantially as hereinbefore described.

It is well settled that Letters Patent will be construed if possible so as to make the claim co-extensive with the patentee's invention.

In the present case the language of the specification throughout shows clearly that the patentee believed himself to be the inventor of a new oil, differing in its physical characteristics and its capacities for use from any oil then in existence. This oil he has made the subject matter of his patent.

The article itself being new, no reason can be given why he should claim it only when made by a particular process. If it were new he had a right to claim it however made. If it were not in itself new he could not, under the patent law, claim it as a new article merely because it was made by a new method.

We submit that under the laws of the United States the patentability of a manufacture is entirely independent of the novelty of the process or means by which such manufacture is produced, and that a reference to the process, in a claim for such manufacture, is to be treated only as a means of identifying the manufacture itself, unless a contrary intention be plainly expressed.

The Act of Congress specifies as the subjects for which Letters Patent may be granted "any new and useful art, machine, manufacture or composition of matter," using the terms disjunctively. Any new and useful art, or any new and useful manufacture, therefore, is patentable. So far as the terms of the statute are concerned, each class stands by itself and has no reference to any other, as much or as though a patent for an art were provided for in one section, and a patent for a manufacture in an entirely distinct section. In each case the patentable qualities specified and required are predicated only of the specific subject sought to be patented, — in the one case the art, in the other the manufacture.

It is true that when the patent is for an article of manufacture, the statute provides that the application shall contain a description not only of the article itself, but also of the manner and process of making it; but the reason why such description of the process is required is clearly stated in the same sentence to be "to enable any person, skilled in the art or science to which the invention appertains, or with which it is most nearly connected, to make, construct, compound or use the same."

There is no suggestion that it is necessary for any other purpose.

The necessary inference from the language of the statute is, that the only inquiry in reference to the patentability, either of an art or a manufacture, is — is the art or the manufacture *in itself* new and useful? and that in a patent for an art, a reference to the character of the product can be material only as tending to show that the art itself is new and useful; and that in a patent for a manufacture, the character of the means by which it is produced is immaterial, and need be referred to only for the purpose of showing the public how to produce the manufacture, except in cases where such reference tends to render more definite the description of the manufacture,

and show that it possesses in itself, as a result of the process, the qualities of novelty and utility required by the statute.

That an art or process is patentable without reference to whether the product be new or old, is too well settled to require the citation of authorities.

It is equally well settled that an old manufacture is not patentable merely because it is made by a new process or upon a new machine, or from a new material.

The Wood Paper Patent, 23 Wall. 593.
Rubber Company *v.* Goodyear, 9 Wall. 783.
Goodyear *v.* N. J. Central R.R. 1 Fisher, 627.
Draper *v.* Hudson, 3 Of. Gaz. 354.
M. & H. Glue Co. *v.* Upton, 6 Of. Gaz. 842.

But if the employment of a new process or machine does not confer patentable novelty on a product which is old, how can it be considered as an essential element in the patentability of an article which is new?

The language of the Courts in the cases just cited is entirely opposed to such an interpretation of the law.

Thus, in the case of the Rubber Company *v.* Goodyear, 9 Wall. 796, Mr. Justice Swayne, speaking for this Court, says: —

"Patentable subjects, as defined by the patent law, are 'any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter.' A machine may be new, and the product or manufacture proceeding from it may be old: in that case, the former would be patentable, and the latter not.

"The machine may be substantially old, and the product new; in that event, the latter, and not the former, would be patentable. Both may be new, or both may be old: in the former case, both would be patentable; in the latter, neither.

"*The same remarks apply to processes and their results. Patenta-*

bility may exist as to either, neither, or both, according to the fact of novelty, or the opposite. The patentability or the issuing of a patent as to one, in no way affects the rights of the inventor or discoverer as to the other. They are wholly disconnected and independent facts. Such is the sound and necessary construction of the statute."

So also in the case of Goodyear *v.* New Jersey Central Railroad, 1 Fisher P. C. 632, Mr. Justice Grier says: —

"It must be obvious also that there is not only a distinction but a wide difference between one who merely invents a new method or process by which a well-known fabric, product or manufacture is produced in a cheaper or better way, and the discovery of a new compound substance or manufacture, having qualities never found to exist together in any other material. In the first case, the inventor can patent nothing but his process and not his composition of matter. In the latter, both are new and original and both patentable, not severally, but as one discovery or invention. It is evident, also, that the question of infringement must in such cases depend on different conditions.

"Steel is a well-known substance, and one, who could devise a new and cheaper method of combining the iron and carbon, in order to form it, could patent his process only; and every other person would be at liberty to devise any different process for effecting the purpose.

"But if steel as a substance was before known, the person who first discovered that a composition of iron and carbon could be made to assume such valuable qualities would have a right to patent not only his process but his product. And no person who had thus taken the benefit of the patentee's discovery, and by it was informed of the valuable qualities of this compound of iron and carbon, could, by varying or improving the mode or process of its production, rob the patentee of his franchise."

The learned judge of the Court below, while admitting in general terms that the patentability of a manufacture depends upon its

intrinsic novelty, attempts to draw a distinction, which we believe to be an unfounded one, between cases where the product is, as he expresses it, "independent of the process," and cases where the process is inseparable from the product and inheres in it after it is made," holding in substance, as we understand him, that in the latter class of cases the product should be claimed "when made by the described process."

Such he held to be the case with Merrill's patent.

The language of the Court on this point is as follows: —

"If the thing produced be new in and of itself, it is patentable as a new manufacture. If it be capable of being produced by various different processes, as, for instance by hand, by the use of hand tools, or by automatic or other machines, yet when the product is independent of the process, the patent is infringed by the unlicensed manufacture of the new product by any mode of manufacture, the process of manufacture being wholly unimportant.

"In other instances, however, not only does a new process produce a new product, but the process is inseparable from the product, and inheres in it after it is made, so that upon inspection of the product, it is manifest that the process must have been employed. Whenever we see the new manufacture, "vulcanite" we know this product was made by the process of subjecting a plastic compound of rubber and sulphur to heat, whereby the chemical change was effected which characterizes the vulcanite.

"It is competent therefore for a patentee, under the appropriate and fitting conditions appertaining to his invention, to claim broadly the new product, however made, or to claim the new product when made by a described process."

We admit, of course, that it is competent for a patentee thus to limit his claim, but so he may also in any case, no matter what may be the character if his invention.

We understand the Court to mean, however, that in the second class of cases mentioned, the patent must be construed in this limited manner from the very nature of the invention, while in the first class it need not.

We submit that this distinction is unsound and the conclusion unwarrantable.

It is doubtless generally true that a product and the process by which it is produced are so closely connected that by strictly following the process the same product will always result, so that a

reference to the process of manufacture furnishes a reliable means of identifying the article.

But the converse of this is not true. In no case can we say with certainty that the "process inheres in the product," so that from an inspection of the product it can be known with certainty by what process it was produced. One process may inhere in it, but so may others also.

Illustrations of this are found in several important branches of manufacture.

Goodyear's vulcanized rubber, for example, is sometimes referred to as a case where the product at once indicates the process employed in its manufacture, viz., the use of sulphur under the action of a high degree of heat; but a process has been invented for producing the same result without heat, by means entirely different.

So steel was formerly produced exclusively from bar iron by exposing it in a crucible with charcoal to a high heat, by which means the iron absorbed a portion of the carbon from the charcoal, and was turned into steel. Recently, processes have been invented for making steel by extracting from pig iron a portion of its carbon, the reverse of the old process, but the article produced is the same.

Sulphuric acid was originally produced by distillation from sulphate of iron, and was therefore termed oil of vitriol. This process has since been abandoned, and the acid is now produced from sulphur by an entirely different method.

These illustrations show that although at the date of the original invention the inventor may suppose that his new article of manufacture can be produced only in the manner he has devised and described, there is no certainty that new processes may not afterwards be invented for producing the same article.

But conceding for the sake of argument that there may be articles capable of being produced by only a single process, we contend that this fact has no bearing upon their patentability.

What is meant by the expression that "the process is inherent in

the product"? Clearly the process itself is not there, but only its results. Nothing more can be meant than this: that the process has impressed upon the product certain characteristic qualities, so that when we find an article possessing those qualities we infer at once that it was made by that process.

If those qualities do not materially change the character of the article, while the process may be new and valuable, the article itself is not patentable.

Articles made by machinery, for instance, can in most cases be distinguished from those made by hand, but this of itself does not make them patentable, as was shown in the cases already cited.

But supposing the qualities thus impressed upon the article to change its character from what was before known, to such an extent as to make it patentable, clearly the ground of patentability is the existence of those new and patentable qualities themselves without reference to whether they were produced by one process or another.

In this case as in every other the question is not, How was the article made? but, Is the article itself new and useful?

The distinction drawn by the Court in the passage above cited amounts, briefly to this: that when the inventor of an article knows that it may be produced in different ways, he may, by the use of appropriate language, claim it, however made, whether by ways of which he is aware or not; but when he knows of no other way of producing the article than that which he describes, and to which of course he must of necessity confine himself in his description and claim, he must limit his claim to the article made in that way only.

If this be the law, the latter class of patents which embody many of the most valuable inventions, will be practically worthless.

New processes are constantly being invented, better and cheaper than the old ones, and which they at once supersede. No matter, therefore, how meritorious the invention of a new article of manufacture might be, if the inventor knew of but one way of producing it, any contriver of a different process could make and sell the article with impunity, and rob the inventor of the entire fruits of his discovery.

Practically, such patents would give no protection to the new manufacture, but only to the specified process.

While it is unnecessary for a patentee to restrict his claim for a new article of manufacture by reference to the process employed, such reference is, as we have already pointed out, a convenient means of describing the article itself, by showing the public how to make an accurate standard for comparison.

In a verbal description of an article it is frequently impossible to avoid ambiguities of expression, especially where the prominent characteristics of the article relate to color, smell, taste, or consistency, even where the article itself is easily distinguished from others. In such case the patentee may well, in addition to his verbal description, claim the article which is produced by following the directions given in the specification. This renders his claim definite and certain. Such we understand to have been Merrill's purpose in referring to his process in his claim.

We know of no decision or even dictum that a claim for a manufacture must be construed as limited to that manufacture when made by substantially the same process as is described in the specification.

In the present case, therefore, although Merrill had invented a new process as well as a new article of manufacture, he had a right to claim the article broadly whether made by that process or not.

The only question is, Has he actually limited himself by the words of his claim to the described oil when made by his described process?

While such a claim would plainly only partially protect him in the exercise of his invention, he undoubtedly had a legal right to make it, and thus claim less than he had invented. The question is, Has he done so?

Recurring to the language of the claim, it is clear that he has not thus restricted himself in express terms. He does not claim his new oil *when made or only when made* by the described process.

What he does claim is, the "above described new manufacture of deodorized, heavy hydrocarbon oils . . . from heavy hydrocarbon oils, by treating them substantially as hereinbefore described."

The most that be said of this claim is that the reference to the process is an ambiguous one, capable of being construed either as a limitation of the claim for the article, or as a further description of it.

Under the former construction the claim would be narrower than the invention; under the latter, it would be co-extensive with it. Under such circumstances, the law is well settled that such a construction shall be given to the claim as to secure to the inventor the whole of his invention or discovery.

In Winans *v.* Denmead, 15 How. 341, the rule is thus stated: —

"Now, while it is undoubtedly true that the patentee may so restrict his claim as to cover less than what he invented, or may limit it to one particular form of machine, excluding all other forms, though they also embody his invention, yet such an interpretation should not be put upon his claim if it can fairly be construed otherwise, and this for two reasons: —

"1. Because the reasonable presumption is that, having a just right to cover and protect his whole invention, he intended to do so.

Haworth *v.* Hardcastle, Web. P. C. 484.

"2. Because specifications are to be construed literally in accordance with the design of the constitution and the patent laws of the United States, to promote the progress of the useful arts, and allow inventors to retain to their own use, not anything which is matter of common right, but what they themselves have created."

And again,

"The patentee, having described his invention and shown its principles, and claimed it in that form which most perfectly embodies it, is, in contemplation of law deemed to claim every form in which his invention may be copied, *unless he manifests an intention to disclaim some of these forms.*"

So in Corning *v.* Burden, 15 How. 269, the Court says: —

"It is true that the patentee, after describing his machine, has set forth his claim in rather ambiguous and equivocal terms, which might be construed to mean either a process or a machine. In such cases

the construction should be that which is most favorable to the patentee *ut res valeat quam pereat.*

In Ransom *v.* the Mayor of New York, 1 Fisher, P. C. 262, Judge Hall says: —

"It is the duty of the Court in construing claims of this character to so construe them, if they can without doing violence to the language used, as not to defeat the claim of the patentee, but to give to the plaintiff what he has actually invented, and to give him all he has actually invented; in other words, *to make the claim commensurate with the invention which has actually been made by the patentee.*

And in Whipple *v.* The Middlesex Co., 4 Fisher P. C. 42, the Court say: —

"If by examination of the specification and applying it to the then existing state of the art, we can learn what the invention was, then the claim, which was designed to be a condensed summary of the invention, is to be construed so as to be co-extensive with the invention, if that can be done without doing violence to its language."

See also,

Kittle *v.* Merriam, 2 Curtis C. C. 478.
Corning *v.* Burden, 2 Fisher, P. C. 489.
Rubber Co. *v.* Goodyear, 9 Wall. 795.
Andrews *v.* Carman, 9 Of. Gaz. 1011.

So universally has this rule been followed, that after careful search we have found no case in this country where a patent has been so construed as to cover less than the patentee's actual invention, except where the language of the claim was unequivocal and amounted to an express disclaimer of every form or part of the invention, except that specifically described and claimed.

Thus in Byam *v.* Farr, 1 Curtis C. C. 263, where the patentee claimed a composition for matches, "without the addition of any highly combustible material, such as sulphuret of antimony," he was not permitted to treat sulphuret of antimony as an equivalent for one of his ingredients, having in his specification disclaimed it as such.

So in Winans *v.* Boston and Providence Railroad, 2 Story 412, the invention being described as an improvement in "railway and other wheeled carriages," it was held that the claim could not be construed so as to be limited to railway carriages only.

And in Rich *v.* Close, 4 Fisher P. C. 282, where the claim was in express terms for a combination of several elements, the patent was held not to cover one of those elements apart from the combination.

See also Wallace *v.* Holmes *et al.*, 5 Fisher, P. C. 37.
Welling *v.* Rubber C. H. Co., 7 Of. Gaz. 608.
Many *v.* Sizer, 1 Fisher, P. C. 31.
Aikin *v.* Bemis, 3 Wood. & M. 354.

In all these cases the language of the claim was specific, and left no room for construction.

Such is not the case with Merrill's. There is nothing in his patent which can fairly be construed as a disclaimer of his oil when made by other methods than that specifically described by him.

On the contrary, the specification shows throughout that he believed his oil to be an article new in itself, possessing valuable and distinctive qualities; and that his invention would be fully protected by patenting it as a new article of manufacture, without making any claim for the process.

The reference to the process of manufacture in the claim, if construed as a limitation upon its scope, was, therefore, entirely unnecessary, and could operate only as an arbitrary abandonment of part of the invention.

The presumption is entirely against a construction involving such consequences.

On the other hand, the construction contended for by the appellant gives the patentee full protection for his invention as described in the specification, while it makes the description and identity of the article claimed more definite and clear than if the reference to the process were omitted.

It is evident that the patentee by the language of his claim did not intend to restrict his invention or his claim to oils produced from the *heavy* hydrocarbon oils which he describes as being well-known to the trade, for in the passage immediately preceding the claim he points out that his invention will be used if distilled hydrocarbon oils are used which are different from those known as *heavy* hydrocarbon oils, that is, oils from which the lighter burning oils and naphthas *have not been removed*. It is true that he says that the naphthas and burning oils will go over first, leaving the heavy oils to be operated upon; but the passage shows that Merrill did not mean to limit himself to the use of *heavy hydrocarbon oils known as such* and to the simple removal of the volatile matters commonly associated with them.

When crude petroleum is used the naphthas and lighter oils are first removed, leaving the heavy oils in the still, which form the deodorized oil, and which is deodorized by the removal by distillation of the lighter bodies which render it offensive. The only difference in the two cases is that with petroleum the removal of the naphthas and light oils and the deodorizing is effected before the heavy oil is separated from the paraffine and tarry matters, while with distilled oils, from which the naphthas and light oils have not been removed, the separation from the paraffine and tarry matters has been effected.

It will appear from the evidence referred to hereafter that when petroleum is used the offensive odors are formed and removed in the same manner as when using heavy hydrocarbon oils.

See Hayes, p. 77, ans. 30.
Silliman, p. 91, ans. 13.

With reference to the method of making the patented oil the specification shows clearly that the patentee did not confine his process to the removal of the light odorous oils which were associciated with the heavy hydrocarbon oils and which gave to such oils their characteristic odor, as was held by the Court below. An equally important part of the process is preventing the formation of such odorous bodies. Without this the first part of the process would be useless.

The patentee says expressly, "From the above it will be obvious that my invention consists in producing heavy hydrocarbon oils suitable for lubricating and other purposes and free from the characteristic odors of heavy hydrocarbon oils from heavy hydro-carbon oils, by distilling from them the volatile matters from which the objectionable odors arise, *and at the same time preventing new formations of such matters by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil.*"

Patent, p. 10.

It is in evidence that prior to Merrill's invention it was believed by manufacturers of oils that the offensive odors which characterized the paraffine oils were inherent in and part and parcel of the oils themselves, and he mentions in his specification as the only processes by which it had been attempted to destroy these odors, the use of chemicals, and filtration.

He for the first time discovered that these odors were due to certain volatile oils associated with the heavy oils, and capable of being removed from them by a process of fractional distillation, so conducted as to form no new odorous bodies.

Having devised and described a process for carrying this discovery into practical effect, he is entitled to claim broadly the produc-

tion of his new oil by any process of distillation which produces such an oil as he has described, free from odorous volatile oils, as distinguished from those processes in previous use, which were conducted on the principle that the odors were inherent in the oils themselves, his process being directed to the elimination of the heavy oil from odorous matters associated with it, while others had endeavored to destroy the odors themselves by chemical means.

In order to a clear understanding of the issues raised by the pleadings, as well as the true construction of the patent itself, it will be necessary to consider the nature of the invention and the history and nature of the class of manufactures to which it belongs.

III.

History of the Introduction and Early Use of Hydrocarbon Oils.

The invention which is to be considered in this case relates to what are called in the patent heavy hydrocarbon oils. They are termed "hydrocarbon" because they are composed of hydrogen and carbon, and do not, like most animal and vegetable oils, contain oxygen.

They have but recently become articles of commercial and industrial importance, but they are now among the most important productions of this country.

They are derived from a variety of sources, are widely different in character, and are applied to widely different uses. Some are

obtained by the distillation of bituminous coals and shales, and some from the distillation of natural asphaltum or bitumen; but at the present time much the largest proportion is obtained from the petroleum wells, and is used either in its natural state, or is converted into a variety of other commercial articles by the process of distillation.

The best known of these is the common kerosene, or burning oil. The hydrocarbon oils which are the subject of this invention are called heavy because their specific gravity is greater than that of the burning oils, which by contrast are often called light oils. The specific gravity of the burning oils is about forty-three degrees as measured by Baumé's hydrometer. The specific gravity of the heavy oils varies from twenty-five or six to thirty-eight degrees.

Though derived from the same substance they differ so widely that the light oils are unfit for use as lubricators, and are almost entirely used for illumination; while, on the contrary, the heavy oils are unfit for illumination, and are mainly used for lubrication. The history of the manufacture of the heavy hydrocarbon oils in this country, and their introduction into use for lubricating purposes, is fully explained by William Atwood and by Joshua Merrill, the plaintiff, in their testimony on pages 23 to 41 of the record, and on pages 42 to 53: —

These gentlemen, in connection with a brother of Mr. Atwood's, now deceased, were the pioneers in this business, having commenced it at Waltham, in this State, as early as 1853 or 1854.

From their testimony it will be found that they first produced a lubricating oil from coal tar, which was put on the market under the name of coup oil. (Page 24, ints. 10 to 13.) This oil, and the mode of using it, and the objections to its use, and the efforts to improve it, are thus described by Mr. Atwood, on pages 24, 25 and 26. —

"We obtained lubricating oil from the more fixed and heavy distillates, the oil having a disagreeable odor, and not having sufficient body to be used as a lubricator alone, but having powerful antiseptic qualities, which made it valuable for mixing with other oils having a tendency to gum or oxidize; making a good lubricating oil of the mixture, with the exception of its odor. We obtained, also, benzole and naphthas." *Ans. to Int.* 10.

. . . . . .

"*Int.* 13. For what purposes was it put upon the market? What class of customers was looked to for using it?

"*Ans.* Mixed with other oils, it was put upon the market as a lubricating oil. All manufacturers using machinery of any kind, and railroads and steamboats were looked to as customers.

"*Int.* 14. What kind of oil was it mixed with?

"*Ans.* It was mixed with whale oil, lard oil, castor oil, and small quantities with other fatty oils.

"*Int.* 15. Was it used to any extent, alone, as a lubricator?

"*Ans.* It was not used at all, alone, to my knowledge.

"*Int.* 16. Why not?

"*Ans.* It lacked body, and would not remain upon the bearings, but ran off.

"*Int.* 17. So far as you know, had any oil of this kind, that is, oil distilled from coal tar or other hydrocarbon bodies, been in use in this country before the company you have spoken of put this oil upon the market?

"*Ans.* It had not.

"*Int.* 18. How was this oil received by the comsumers? How fast did it make its way into use?

"*Ans.* It was received by the owners of mills with a great deal of favor, but opposed by their operatives. It was introduced rather slowly and with a great deal of labor, owing to its offensive odor.

"*Int.* 19. Why was it received with favor by the mill owners, and why was it opposed by the operatives?

"*Ans.* It was received with favor by the mill owners because it proved to be an excellent lubricator when mixed with other oils; and opposed by the operatives on account of its strong, pungent, persistent odor."

. . . . . .

"*Int.* 24. Did you make any effort to remove that odor, in order to free your oil from the objection which the operatives made to it? If so, state what was the nature of the efforts you made, and how constant or persistent they were.

"*Ans.* We did make efforts to remove the odor, applied all known chemical agents likely to destroy or modify the odor, as well as varied the modes of distillation; and were constantly searching for improved processes, and finally commenced experiments upon other substances, as the source from which to make the oil."

. . . . . .

"*Int.* 26. You have spoken of your efforts to improve the character of this oil as to its odor, by chemical means and by improved methods of distillation. What success attended these efforts?

"*Ans.* A considerable degree of success, — so much so as to almost change the character of the oil.

"*Int.* 27. Did it change its character in any other respect than as to its odor?

"*Ans.* Only in respects to its color.

"*Int.* 28. As to its odor, did you succeed in changing it sufficiently to remove the objections which the operatives had made to its use? What was the extent of the change?

"*Ans.* We did not. The extent of the change, however, was such as to be acknowledged, even by its bitterest opponents.

"*Int.* 29. Did you succeed in changing it sufficiently, by these means, to render any further efforts for its improvement in that direction, unimportant in your own judgment?

"*Ans.* We exhausted the resources of chemistry, without accomplishing it; that is, the resources, so far as anything was brought to our knowledge at that time."

This coup oil, the pioneer among the hydrocarbon lubricating oils, has gone out of use. (Page 28, int. 40.)

The parties who introduced it, in their efforts to obtain a better oil, resorted to new materials for its production, among which was petroleum. We quote further from Mr. Atwood's deposition (page 26): —

"*Int.* 30. In a previous answer you stated that, in your efforts to overcome this objection, you finally commenced experiments upon other substances, as the source from which to make the oil. What were the substances upon which you made the experiments, and what came from the experiments?

"*Ans.* We experimented upon bituminous coals, bituminous shales, asphaltums, and petroleums, — petroleums and bitumens from nearly all the known sources, and many different varieties of coals and shales. We succeeded in producing what we regarded at that time as a good lubricating oil from each of these different sources, having so much less odor than the coup oil that we considered we had no difficulty in introducing any one of them into the trade."

. . . . . .

"*Int.* 35. You stated that you resorted to the other substances you have named as a source from which to procure oil for the purpose of obtaining an oil free from the offensive odor of the oil you made from coal tar. Will you state how the oil obtained from these new sources differed in respect to its odor, or in any other respect, from that made from the coal tar, and whether it was put into the market under the same name, and to be used for the same purposes?

"*Ans.* Its odor was of a different character, less offensive, not affecting the eyes of the person going into a warm room where it was in use, in the least, whereas some persons did complain of the coup oil affecting them in that way. The odor did not adhere to clothing so tenaciously as that of the coup oil odor. It was very much more oily, so much so as to lead many to think that it might be used alone as a lubricator. It differed also in chemical composition, there being three classes of oils properly denominated hydrocarbon oils, of which coup oil was one, it containing the largest amount of carbon compared with the hydrogen. The coal oils, shale oils and petroleum oils being another, containing the least amount of carbon in proportion to the hydrogen. The asphalt oils containing an intermediate quantity of carbon compared with the hydrogen. The second class of oils constituting those now known as paraffine oils. It was not put upon the market under the same name, but was put upon the market to be used for the same purposes.

"*Int.* 36. When you speak of the oils obtained from the coals as being more oily

than that which you obtained from coal tar, do you refer to a difference in respect to what you mentioned as to the coal tar oils, of a want of body?

"*Ans.* Yes, sir."

. . . . . .

"*Int.* 42. In a previous answer, in speaking of the paraffine oil, you said it was very much more oily than the coup oil; so much so as to lead many to think that it might be used alone as a lubricator. Did experience confirm this, and if so, to what extent?

"*Ans.* I hardly think I can say experience confirmed that; still, it has always been used, by a few person, for special purposes alone, as a lubricator. Not to a very great extent, however.

"*Int* 43. What are those special purposes, or special cases?

"*Ans.* Those having light, quick-running machinery, and small machine shops; for oiling shafting. More particularly from the taste of the person having charge of them than for any other reason.

"*Int.* 44. You have spoken of the different odor of this oil as compared with that of the coup oil. Did this difference prove to be such as to relieve the oil from the objections which were entertained as to the coup oil, in whole or in part, and to what extent, if in any degree?

"*Ans.* The difference, I think, proved to be so great that, in the same state of the market as that in which we introduced the coup oil, there would have been no objection raised on account of odor; but when we introduced those oils known as paraffine oils, sperm oil and the better class of oils for lubricating purposes, were very much cheaper, and manufacturers were not so anxious to find a substitute for them. Still the complaints were very much less and the difficulties of introducing it very much less than the difficulty of introducing coup oil in the circumstances existing at the time that was introduced."

On page 29, int. 53, the witness states that petroleum was resorted to for obtaining paraffine oils in 1858, that in 1861 and '62 it was very generally used, and that in 1866 it became the exclusive source; but it is well known that petroleum has been chiefly used to obtain burning oil.

On page 29, ints. 54 and 55, he states that the lubricating oils obtained from coals and asphaltum were essentially the same as that obtained from petroleum.

On page 29, ints. 49 and 50, page 30, int. 59, and page 31, int. 67, the witness states that the lubricating oils made by his company at Portland, and that made by the Downer Kerosene Oil Company of which Mr. Merrill is a member, before Merrill made the improvements which are the subject of his patent, were the best made in the country, and commanded the highest price.

On pages 31 and 32 he states that the improvement of these oils

had been a subject of repeated effort by him and the Downer Company ever since the oils were introduced. Mr. Merrill also testifies on page 58, int. 32, to his constant efforts in the same direction. The character of the oil produced by both these companies, before the date of the invention which is the subject of the suit, will be considered in another part of the brief. It is sufficient here to observe that the coup oil when introduced was a new and different article from anything which preceded it; that the paraffine oil was essentially different from the coup oil, and supplanted it, although itself open to serious objections; and that its improvement, or the production of a better article to take its place, or occupy places from which it was excluded by reason of its defects, was recognized as an important object. Such improvement was therefore a legitimate subject for the exercise of invention, and might require invention of the highest order, and when effected would be a proper subject for the protection of the patent law.

IV.

Distillation of Hydrocarbon Oils. — Modes of purifying.

We have stated that various hydrocarbon products are produced from such bodies as coal, coal tar, asphaltum, and petroleum, by subjecting those substances to the process of distillation; but it is also true that a variety of products can be obtained from each of them by the same process. A brief statement of the manner of conducting this process as applied to petroleum, and of the results which it may be made to yield, will aid the investigation in this case.

The oil is placed in a close still, connected by a pipe from its top with a condenser; when heat is applied to the still, vapors rise from the oil and pass over to the condenser and are there condensed into liquids.

The vapors which come over first are very light, and the liquid obtained by their condensation is much thinner and lighter in color and gravity than the petroleum from which it is distilled. Dr. Tweddle, on page 166 (int. 90), mentions rhigolene and gasoline as the first products; but as they have no great commercial importance and are not made the subject of further testimony in this case, we pass to the next product mentioned by the doctor, viz., naphtha, which with oil-refiners is generally the first product separately collected. It is a white, thin, mobile fluid, highly volatile and inflammable, and not generally recognized as an oil.

As the distillation proceeds the specific gravity of the condensed products increases until it reaches sixty degrees Baumé. At the same time the oil in the still becomes darker in color, more oily in character, and of a greater specific gravity.

From the point where the condensed products of the distillation reach a gravity of sixty degrees until they are of a gravity of about forty degrees they are of an oily nature, and are known and used as burning oil. The oil in the still has in the mean time continued to become darker, thicker, and heavier.

Now it is important to observe that the character of the products obtained from the distillation, especially from this point, may be essentially affected by the manner in which the distillation is carried on. If it proceeds in a manner which involves what is known as destructive distillation, the products will be much lighter in character than they will be if the conditions are such as to secure what is called a fractional distillation. The difference between these two kinds or forms of distillation is explained by several of the witnesses, but it may be briefly stated, that by destructive distillation the character of the body acted upon is changed so that the products if mixed together would be unlike the original material. When petroleum is subjected to *destructive distillation* the condensed products become more light and volatile, according to the extent to which the process is carried; and it may be carried to such an extent that the vapors formed are permanent gases which cannot be condensed into liquids. A familiar instance of destructive distillation is seen in the production of illuminating gas from bituminous coal.

Fractional distillation takes place when a mixture of two or more liquids having different boiling points is separated into its constituents. A mixture of alcohol and water will be separated in this way: the alcohol, by reason of its lower boiling point rising in vapor at a lower temperature than water, will be carried separately to the condenser and there condensed while the water remains in the still. In distilling petroleum the more volatile portions may be carried over separately to the condenser, thus separating the contents of the still into two or more bodies differing in gravity and in other qualities; or nearly the whole mass may be converted into light or burning oils, or even into naphthas or permanent gases. Generally the manufacturers of petroleum have desired to convert all or nearly all of the crude petroleum into burning oil. To do this it is necessary, when the product of the distillate reaches a gravity of about forty, to so conduct the process as to ensure the destructive distillation of the crude material. This is done by carrying on the distillation from this point so slowly and under such conditions that the vapors condense largely in the still and fall back into the mass of oil at the bottom, to be again vaporized. This is known among refiners as the cracking process.

Merrill, page 56, int. 29.
Atwood, page 30, ints. 60 to 62, page 33, cross-int. 4, page 33, cross-int. 11, pages 34, 35, cross-ints. 16 to 19.
Hayes, page 79, cross-int. 7, page 82, cross-ints. 30, 31.
Tweddle, page 166, int. 90.

If, when the distillation reaches the point where the distillate has a gravity of about forty degrees, the process is continued without cracking, a heavy oil is obtained, which is used, not for burning, but for lubricating.

Merrill, page 56, int. 30.

In addition to the naphtha, light oil and heavy oil, which are or may be obtained by the distillation of petroleum, there can be generally separated from the heavy oil as it comes from the condenser a substance called paraffine, and there usually remains in the still a small quantity of tar or coke, making five products in all.

When the distillation is carried on in such a manner that the cracking process is practised to the last stage, the products are naphtha and illuminating oil as distillates, and a small amount of tar or coke as a residuum. The proportion of naphtha obtained varies with the gravity of the crude petroleum. From crude oil of 45° or 46° gravity about fifteen per cent of naphtha is obtained; from oil of 36° gravity, very little is produced.

The proportion of burning oils produced varies not only with the gravity of the crude oil, but with the manner in which the distillation is conducted. When the oils are not cracked the lighter petroleum above mentioned yields forty-five or fifty per cent of burning oil, and the heavier petroleum yields from fifteen to twenty per cent. If cracking is practised, the whole body of the oil, after the naphtha is removed, is converted into burning oil, with the exception of the small residuum of tar or coke. Therefore, when it is found that the naphtha and burning oil produced are nearly equal to the original petroleum, it is certain that cracking has been practised.

As the products of distillation come from the still, they are generally in a condition to require further purification, to remove to a greater or less extent certain odors which pertain to them. Some of these odors are due to the formation of sulphur compounds during the process of distillation. A chemical treatment of the oil with acids and alkalies is resorted to for removing these odors, and also an odor which the witnesses describe as a still smell. This treatment with chemicals is frequently spoken of as refining. It not only removes some of the odors, but it renders the color lighter. Another process resorted to at times for improving the color and odor of the oil is to filter it through animal charcoal.

V.

Nature of the Invention.

The specification, in describing the character of the new article which Merrill claims to have produced, refers to several varieties of oil from which his oil differs; and the importance of the specific character of his oil will be made more apparent by considering for a moment the well-known differences between various oil, and the characteristics of different oils which serve to distinguish them as different articles, and which fit them for different uses and give them different values. It is a matter of common observation that a great variety of oils are known in commerce and the arts as having such different properties and as being applicable to such different uses that they are universally recognized as different articles, and are known by different names. Sometimes their names have reference to the source from which the articles are obtained, sometimes to the uses to which they are most generally applied, sometimes to their chemical composition, and sometimes to some peculiar property which the article possesses. Sometimes the same article is known under a variety of names. These oils differ greatly in specific gravity, in color, and in taste and odor. They differ greatly in their mobility or fluidity, and in what is called their body. They differ greatly in their boiling points and in what may be called their freezing points, or in the temperatures at which they become solid. They differ greatly in the persistency with which they retain their characteristics or peculiar properties, or in the facility with which they surrender them and are decomposed or changed.

Referred to their origin, we hear of vegetable oils, animal oils, fish oils, and mineral oils. We have sperm oil and whale oil, two widely different articles. Lard oil and neat's foot oil are widely known as two different kinds of animal oils. Among vegetable oils we have olive oil, linseed oil, palm oil, and many other well-known varieties. Of mineral oils, we have coal oil and petroleum oil, the latter a natural product, the former an artificial product, and of each of these there are many varieties. Many other examples might be given, but the small[illegible] are sufficient to show that by the common observation, expe-

rience and judgment of men many different kinds of oils are recognized, and named as essentially different articles.

They differ greatly in the uses to which they are capable of being applied. Some are used for illumination, some for lubrication, and some for fuel. Some are used as a medium or vehicle for paints, some for finishing leather, and some for the manufacture of soap. Some are used medicinally, and some as articles of diet.

In commerce they differ greatly in price or value.

Among the oils which are now known in commerce and the arts is a class before referred to, called hydrocarbon oils. As before stated they are so called because chemically they are compounds of hydrogen and carbon only. In addition to these elements many oils contain oxygen. The oils previously mentioned as coal oils and petroleum oils are hydrocarbon oils, and there are others still which belong to this class.

The hydrocarbon oils belong to a yet wider class of bodies composed of hydrogen and carbon in different proportions, but differing amongst themselves so widely that at ordinary temperatures some are solid, some are liquid, and some are permanent gases. Even those which are liquid differ so much from each other that some are by the common judgment of men recognized as oils, and others are classed with spirits or ethers.

The bodies having the largest proportions of hydrogen are permanent gases, of which the common illuminating gas when pure is an example. Smaller proportions of hydrogen give light volatile liquids of different kinds, of which the one best known is benzine. Reducing the proportion of hydrogen still further, the bodies produced are light oils, an example of which is found in the common kerosene oil. A still further reduction in the proportion of hydrogen gives a heavier oil, unfit for illuminating purposes, but having properties which enable it to be used with more or less success as a lubricating oil. Below this there comes a class of bodies not recognized as oils, but having, some of them, the character of wax, and some of them a tarry character. An example of the wax product is seen in paraffine, which at ordinary temperatures is not a liquid but a solid, and which when melted does not have the character of an oil, being as limpid as water, and having no more lubricating

properties than water. When solid it is white and free from taste or smell. Totally unlike this is asphaltum, one of the tarry bodies, a solid, or a thick, pasty liquid, black, and of a more or less offensive smell. Even the oils known as petroleum oils differ widely from each other as they c me from the earth. Several varieties have been described in the evidence in this case.

Merrill, pages 413, 414, int. 3, and page 417, int. 13.
Tweddle, page 234, cross-int. 363.

Petroleum as it comes from the earth, or crude pretoleum as it is generally called, is used to some extent in the arts, one variety from West Virginia being used quite extensively as a lubricator upon railroad cars and engines and other heavy machinery.

The various kinds of crude oils produced in this country are described by Mr. Merrill, page 417, int. 13.

But the greater part of the crude petroleum produced is subjected to the process of distillation, by which it is converted into a variety of products widely differing from each other and from the original petroleum. Of these products, that which has hitherto been the best known and the most widely used is the illuminating or burning oil, commonly called kerosene. This oil, so valuable for illumination, has little or no value for lubricating purposes. It is of light color and light gravity, is highly inflammable, and has a well-known, characteristic smell, by which it is readily distinguished from other oils.

But petroleum, when distilled, yields another commercial article of considerable value, not classed as an oil, — a limpid, volatile fluid of light color and light gravity, known as naphtha or benzine. It also yields or may be made to yield other highly volatile products, and even a permanent gas.

These examples of different kinds of oils, and of the different values they have, and the different uses to which they are applied, prove conclusively that the differences between them are real and substantial, and that as great and as substantial differences may and do exist between hydrocarbon oils themselves, and even between the specific products of petroleum, as between vegetable and animal oils. Where such differences exist, it is obvious that the field is a

legitimate field for invention or discovery, and that the different kinds of oils may be capable of such improvements as to make the improved article a proper subject for the protection of the patent law.

This brings us to a consideration of the real character of the improvements which Merrill claims as his invention. He claims that he has produced and added to the list of oils an oil not before known, or at least an improved oil, having characteristics as distinct and well-defined as those of any of the various oils recognized in commerce and the arts as separate articles; and that, whether regarded as a new article or merely as an improved article, it is so important an improvement, and so valuable a contribution to the arts, that under the patent law he is entitled to it exclusively; and that his patent does grant and secure to him the exclusive right to make, use and sell it.

VI.

Character of the Oils in Use prior to Merrill's Invention.

In giving the history of the hydrocarbon oils mention was made of the introduction of the so-called coup oil, and of the oils distilled from coals, shales and asphaltum. At the time of Merrill's invention the use of these oils had almost ceased, the oils produced from petroleum having taken their place. An oil known as Maysville oil, produced from a coal found in West Virginia, continued to be used until about 1867 or 1868.

Maysville Oil.

This Maysville oil was made by retorting the coal, as in the ordinary process of making gas, treating the condensed vapor with sulphuric acid to remove the tar, and redistilling the product with caustic soda. After distilling off the lighter oils, the heavy portion was again treated with sulphuric acid and soda, and the paraffine then extracted from it. It was then ready for use.

Leyland, pp. 138, 139.

This oil was much thinner in body than Merrill's, although of heavier gravity; contained considerable percentages of thin volatile oils; and had a strong, disagreeable odor.

Merrill, p. 435, int. 69.

Chapin admits (p. 98, int. 20) that complaints were made of its want of body.

The gravity was 26°, while that of Merrill and the neutral topaz oil have a gravity of about 30° and upwards.

Whitney, p. 101, int. 13.

Notwithstanding its greater gravity, it gave off volatile vapors in Horsford's experiment, 38° lower than Merrill's oil.

Horsford, pp. 306, 307, int. 5.

This is very clear evidence of a difference in the essential characters of the oils.

As to the objectionable odor of the Maysville oil, see also testimony of defendants' witnesses.

Millspaugh, int. 14, p. 299.
Chapin, int. 20, p. 98.

As used, this oil was almost always mixed with fatty oils.

Bailey, int. 13, cross. 20, p. 130.
Cowee, cross. 25, pp. 144, 219.

A sample of this oil, marked "Exhibit No. 121," has been produced by the complainants. Its odor is well marked. No witness undertakes to say that it was like Merrill's oil, or the neutral topaz. The omission to institute such a comparison is very significant, because one of the defendants' witnesses (Millspaugh, p. 298), claiming to have a full knowledge of not only this oil, but of Merrill's and Tweddle's, was called on to compare the two last named oils.

It is clear from the testimony of Chapin (p. 101, cross-int. 49) that it was liable to stain goods. See also testimony of Shove, pp. 322, 323.

Paraffine Oils from Petroleum.

These were the principal hydrocarbon lubricating oils in the market at the date of Merrill's invention. They were obtained by distillation from petroleum, but owing to differences in the mode of manufacture and the nature of the raw material operated upon, they differed much from each other both in color, odor, specific gravity, and lubricating qualities.

Two distinct classes of lubricating oils are obtained by distillation from petroleum, viz., the residuum consisting of the thick, heavy oil left in the still after the lighter oils have been distilled off, and the distillate oils, which are those generally referred to in the record as paraffine oils and which are obtained by condensing the heavier vapors raised from the oil in the process of distillation.

The former classes of oils were nearly all of a dark-green color, dependent, however, in this respect somewhat on the stock from which they were made; were thick and viscid in body; and were adapted only for lubricating the heavier and coarser kinds of machinery.

Mr. Merrill thus describes the manner in which such an oil was made at the Downer works: —

"I have myself manufactured thousands of barrels of petroleum distilled by fire and steam, distilling off first the naphthas, then the burning oils, continuing the distillation until a gravity of about thirty-eight degrees Baumé was reached, when the distillation was stopped, and the oil remaining back in the still was comparatively free from odor, of a thick, viscid nature when cold, and contained neither tar nor coke, and was an excellent lubricating oil for coarse machinery, and was made expressly for that purpose"

Merrill, p. 415, int. 8.

A similar process was employed by Tweddle.

Tweddle, p. 201, cross-int. 84.

And the product sold by him as railroad axle oil.

Tweddle, p. 211, cross-int. 187.

The article was one frequently produced by other petroleum manufacturers also.

Merrill, p. 416, int. 11.

We do not understand that it is contended that these residuum oils in any manner resembled or anticipated Merrill's invention; and we refer to them only to describe them as one well-known class of hydrocarbon oils in use both before and since Merrill's invention.

The residuum oil from "Smith's Ferry" petroleum (which is peculiar in being of a light-yellow color instead of being dark-green like other petroleums) is light-colored and nearly deodorized, but differs only in these respects from the heavy green oil already mentioned. (Merrill, int. 21, p. 421.) It differs from Merrill's oil in never having been raised in vapor, being only a residuum of crude petroleum; and again in containing a granular, undeveloped paraffine which refuses to crystallize, and which it is impossible to remove from the oil. This substance causes the oil to chill easily, rendering it thick and viscid upon a slight reduction of temperature. It is inapplicable to many of the purposes for which Merrill's oil is used.

Merrill, p. 421, ints. 23, 24.

The process of making, and the character of the paraffine oils which were distillates and which were known as heavy hydrocarbon oils and with which the patented oil must be compared, are thus described by Merrill, speaking of the oils as produced at the Downer works before his invention: —

"It has been the practice at the works of the Downer Company, in distilling petroleum, prior to the date of my discovery of my deodorized oil, as follows: The crude petroleum is placed in a still, of the capacity of about three hundred barrels, and by means of a steam coil placed within the still, through which a circulation of steam is maintained, we proceed to remove by distillation, effected by the steam heat, that portion of the crude petroleum known as naphtha, running into separate tanks the naphtha portion, until the gravity reaches sixty degrees Baumé, at sixty Fahrenheit. At this stage of the distillation, the steam is shut off from the coils, and the crude petroleum, from which the naphtha has been removed, is pumped into stills of a capacity of one thousand gallons, the stills being so arranged, that a fire may be placed underneath, and a circular flue, set in brick, extend around the sides of the still to within a few inches of the top. We proceed in the fire stills to continue the distillation of the crude petroleum, which will be at the com-

mencement a burning oil, of a gravity heavier than sixty degrees Baumé; and the distillation is continued until the oil running from the condenser has a gravity of thirty-six degrees Baumé, at sixty Fahrenheit. That portion of the oil distilling over, between sixty and thirty-six degrees, constitutes the burning oil, which is run into separate tanks by itself. Without diminishing the fire or slowing the distillation, we proceed to distill in a rapid manner, and with as little breaking up or cracking of the heavier oils as possible, continue the distillation until the oil becomes too foul or objectionable in its character to be saved for lubricating oil. That portion of the distillate which comes over, after the oil is no longer fit to save for lubricating oil, is run into a tank by itself, and the still run to dryness, or coke. The portion last described, when sufficiently accumulated, is again distilled in a rapid manner, and that portion of the distillate which weighs heavier than thirty-six degrees Baumé, and is sufficiently good in color, is run in with the lubricating oil first distilled from the crude petroleum direct, as described. The object of this method of distillation is directly the reverse of that at first described as the cracking process. In the last-described process, a very large amount of lubricating oil is produced from crude petroleum, varying somewhat, according to the character and gravity of the crude petroleum used, but generally equalling about twenty to twenty-five per cent of lubricating oil from the crude petroleum. The burning oil portion, before alluded to and manufactured by this process, is first treated with four ounces of sulphuric acid to the gallon of oil, and after careful washing with water to remove the excess of acid held in suspension in the oil, it is treated with a solution of caustic alkali, to neutralize all remaining traces of acid. After this treatment, the burning oil is again distilled and separated into its various gravity oils, but the main portion of the distillate consists of burning oil. When the gravity reaches thirty-six degrees Baumé, at sixty degrees Fahrenheit, the oil flowing from the condenser in this distillation is run into the lubricating oil tank, until in color it is no longer suitable to be saved for lubricating oil; at which stage the offensive, dark-colored oil is permitted to flow into the separate tank, before mentioned. The lubricating portion of the oil distilled from the crude petroleum, below thirty-six degrees Baumé, is sometimes chilled, by the use of ice, to a temperature sufficiently low to crystallize the main portion of the paraffine it contains in solution. After the chilling and pressing, the oil is subjected to a treatment of acid and alkali, to, in a measure, remove the offensive odors with which it is associated or combined, in which condition, when thoroughly bright and clear, it is ready for sale as a lubricating oil. The lubricating oil as described by this process was known as machinery oil and sold under that brand. To manufacture a still finer quality of lubricating oil, it was our practice before chilling and pressing the once distilled heavy oil, made from the crude petroleum, to first treat the oil with acids and alkalies, and then to distil the oil the second time, dividing, as at first, all the oil that came over above thirty-six Baumé, into burning oil, and all that came over below thirty-six Baumé, into lubricating oil; and this oil so treated, after chilling and removing the paraffine from it, was of a very beautiful light lemon color and sold under the brand of spindle oil. Other manufacturers of lubricating oils usually employ the tarry residuum for the purpose of producing, by distillation from it, a paraffine lubricating oil. The tarry residuum referred to is the product from a distillation of crude petroleum, where the cracking

process, before referred to, has broken up or changed the heavy oils which exist in crude petroleum, into thin burning oils, leaving a comparatively small percentage of paraffine oils in the residuum. The use of acids and alkalies is resortod to to purify the lubr cating oil made from the residuum and improve its color and smell. It is the usual practice to treat those oils with acids and alkalies before the paraffine is removed from the oil. We have used various kinds of distilling vessels in manufacturing lubricating oil, and a great variety of forms have been used by the Downer Company, and by others, for that purpose. It is sometimes the practice, during the distillation of the lubricating oils, to admit steam as it comes from the boiler, superheated, into the body of the oil in the still, during the process of distillation. I have also long known that distillation has been performed with the aid of steam and a vacuum, or partial vacuum, in the distilling vessel, during the distillation."

Merrill, p. 56, int. 30.
See also Merrill, p. 413.
Tweddle, p. 165, int. 88.

Substantially the same general process was employed by other manufacturers, though each had his own peculiar mode of carrying out the details.

The best of the oils varied in color from lemon to orange color. They had also a peculiar, pungent, offensive odor which readily distinguished them from any other class of oils. In respect to specific gravity they were somewhat lighter than the residuum oils, and were deficient in body, so that they were seldom used pure for lubricating purposes to any considerable extent, but nearly always mixed with some fatty oil.

Dr. Hayes, who had for several years practical experience in the manufacture of these oils, says: —

"They always had peculiar and offensive odors, peculiar colors, peculiar tastes. They were mixtures of light and heavy bodies. They were used for lubricating machinery of different kinds, but were never entirely satisfactory to the consumers."

Hayes, int. 7, p. 73.

Speaking of these oils also, the real defendant in this case, Dr. Tweddle, says in his patent of February, 1870, after describing the ordinary process of manufacture: —

"The oil pressed out is heavy, of offensive odor and a characteristic blue or green color. Then a subsequent severe and expensive chemical treatment is required to decolorize both the paraffine and oil, and to somewhat deodorize the oil.

"After being thus purified, such oils are used as lubricants, but they are very deficient in body, and contain animal or vegetable oils, which compounds assume, to a great extent, the blue and green tint above referred to, which in commerce is objectionable, and paraffine oils thus made do not command a ready sale for the above reasons." — *Page* 446.

The statement that these oils contain animal or vegetable oils is explained by Dr. Tweddle (p. 221, cross-int. 280) to refer to compounds.

Here we have the testimony of the real defendant himself as to the state of the art at a period subsequent to Merrill's invention, and when the ordinary processes of making paraffine oils may, in the natural course of things, have been superior to those used prior to Merrill's invention; and this evidence comes with the greater force, since Tweddle adduces it as the foundation on which to claim for himself an oil, substantially the same as Merrill's, as a new article of manufacture.

The correspondence in the descriptions given of these oils in Tweddle's patent and in Merrill's is very noticeable, showing that they both recognized the same state of facts.

Some of the distinguishing qualities of these paraffine oils will be best shown by considering some of the objections made to their use by consumers and others. These objections relate principally to the odor, want of body, staining of goods where oil had dropped upon them, and the formation of a deposit upon the windows of rooms where it was used.

Merrill says that although the lubricating oils manufactured by the Downer Company, prior to the discovery of the deodorized oil, were of an excellent character as regards odor and body, in view of the state of the art at that time, objections were made.

"We had more or less complaint of them, when used in close rooms like cotton or woollen factories, on account of a pervading odor they gave to the whole room Complaints were also made by the consumers that the oil flew from the bearings when applied to machinery under rapid motion, and it seemed to lack the body requisite to lubricate machinery under rapid motion in warm rooms."

Merrill, p. 58, int. 32.

There were also complaints as to the effect of the oil in coating the windows of rooms where it was employed to a degree sufficient to seriously obstruct the light.

Merrill, p. 59, int. 37.

The dealers in paraffine lubricating oils all agree that their customers desire an oil that is a good lubricator, free from odor and acids and from staining properties, and that a light color is preferred in the market.

Treat, p. 45, int. 7.
Smith, p. 14, int. 14.
Squier, p. 18, int. 5.
Parks, p. 22, int. 4.
Maguire, p. 41, int. 6.

Maguire also testifies that for use on wool an oil is desired which is entirely free from the characteristic odor of petroleum oils.

Maguire, p. 42, int. 8.

At the date of Merrill's invention the two principal manufacturers of paraffine lubricating oils were the Downer Kerosene Oil Company, of which Mr. Merrill was superintendent, and the Portland Kerosene Oil Company, of which Mr. Wm. Atwood was superintendent. Both these companies made lubricating oil of first-class quality a specialty; and the testimony of Merrill and Atwood shows that they were both constantly endeavoring to improve the quality of their products. For several years the superintendents were constantly visiting each other's works and were familiar with each other's operations. Their processes of manufacture were similar and their products were substantially alike, standing side by side as the best of the oils in the market.

Atwood, p. 31, int. 67.
" p. 29, int. 49.
Merrill, p. 59, int. 34.

If therefore it appears that the plaintiff's oil is in any particular an improvement upon the oils produced by either of these parties,

we may safely assert that it is in the same respect superior to any of the oils then in the market.

Smith, who had been a dealer in paraffine oils for ten or twelve years, says that prior to the spring of 1869 he had complaints frequently from purchasers in regard to the offensiveness of odor and want of proper body in the paraffine oils then in the market, and that this was a general objection to the use of paraffine oils.

Smith, p. 14, ints. 15, 16.

Squier, another large dealer in paraffine oils, speaks of complaints of mixed oils, composed in part of paraffine, on account of the strong odor.

Squier, p. 19, int. 9.

Parks, another dealer, says, "We have had more or less complaints. The complaints have been more or less in regard to color and lightness of body. Some few complaints of the smell of oil."

Parks, p. 22, int. 10.

Maguire, also a dealer and manufacturer, says, "The complaints were frequently made of the smell arising from the use of these oils, and their liability to run black in machinery, owing to the presence of acids."

Maguire, p. 42, int. 15.

This witness did not regard these oils as adapted for use at all, as a wool oil, on account of the pungent smell and low boiling point.

Page 42, int. 14.

Treat, a dealer in manufacturers' supplies in Lawrence, Mass., testifies as follows: —

"*Int.* 11. Whether or not, prior to the time when you sold to your customers Merrill's Patent Oil, you had any complaints from them of the paraffine oils you then dealt in, with regard to body, odor and color? And if so, state what those complaints were.

"*Ans.* The complaints were numerous, and my sales fell off. They were want of body and principally from the offensive odor of the oil, and some complaint of color; though not a serious one as to color.

"*Int.* 12. Whether or not any of your customers ceased to use paraffine oils altogether?

"*Ans.* Some of them did. Many decreased their orders for paraffine oils, even when used on large journals."

Treat, p. 45.

Cumnock, agent of the Boott Cotton Mills, Lowell, has used Portland paraffine oil, Seccomb, Kehew & Thayer's oil, the old Downer oil and others; he now uses Merrill's oil.

Cumnock, p. 94, ints. 4, 9.

He testifies further as follows (p. 95): —

"*Int.* 11. Do you find any difference between the deodorized oil which you are now using and the paraffine oils which you used before you commenced with this oil, in respect to odor? If so, will you state what it is?

"*Ans.* I do find a difference. In our oil-room, when shut up over night, the odor was so offensive in the morning that the man in charge of the room had to open the doors and windows before he commenced work, — I mean with the old oils. With the present oil which we are now using, we have no difficulty of that kind. The old oil also affected the eyes of the man in charge. With the new oil there is no trouble of this kind. With the old oil the room was so charged with odor that the water would frequently run out of the eyes of a person going in there. I have noticed myself that after going in there my eyes would frequently smart for some time after coming into the air.

"*Int.* 12. By oil-room do you mean the room where the oil was stored and from which it was distributed?

"*Ans.* I do.

"*Int.* 13. Will you state whether or not the odor of the old oils was found objectionable in the rooms where the oil was used, and how it compared with the new oil in that respect?

"*Ans.* The old oil had a very bad odor. Now there is no perceptible odor.

"*Int.* 14. How was it with the old oil in respect to staining goods or clothing with which it came in contact, and in respect to charging the clothing of the operatives with its odor?

"*Ans.* We had frequent complaints from the bleachery in regard to the goods being stained, so much so that we increased the quantity of sperm, at times, to avoid the difficulty. We had frequent complaints from the operatives of the odor of the oil imparted to their clothing, so much so that parties on the street passing them could smell it very readily."

Deming, overseer of spinning at Tremont Mill, Lowell, says that complaints have frequently been made to him of the offensiveness of the oils used at the mill, and that the odor has a great effect upon the operatives.

Deming, p. 126, cross-ints. 33, 34.

Bowker, paymaster at the Atlantic Cotton Mills, Lawrence, testifies that prior to 1866 Downer's spindle oil was used at the mills; that it was found not to be a good lubricator, and that it destroyed the polished surface of the spindles: —

"The operatives complained some of the odor; but many of them more especially of an eruption upon the skin which they said it caused. There was also a deposit upon the windows."

Bowker, p. 134, int. 16.

Paraffine oils were afterwards discontinued on the spindles of the spinning frames on account of their staining the goods.

Bowker, p. 135, ints. 22, 24.

Shove, agent of Granite Mills, Fall River, has used the Maysville oil, Secomb, Kehew & Thayer's oil, Portland oil, the Smith & Merrill, the Yeomans & Goss, and others; —

"The result of most of these oils was unsatisfactory, varying as the quality of the oils varied from the cheaper oils to the deodorized. The objections were principally the offensive odor in the mill, the discoloration of the machinery and windows, and in some cases hot bearings. It would be difficult to discriminate between the several kinds of oil. I found them all more or less objectionable and unsatisfactory."

Shove, p. 322, int. 13.

Perkins, employed in Lowell Bleachery, testifies that great difficulty was experienced with goods stained by paraffine oil in the process of manufacture, but that since 1869 there has been hardly any difficulty with anybody's goods.

Perkin's, pp. 127, 128, int. 4, cross-int. 15.

The foregoing testimony relates principally to the use of the old paraffine oils for lubricating purposes. Wool manufacturers also use oil to sprinkle upon their wool in the process of manufacture. Maguire, a dealer in wool oils, says the character of the old paraffine oils was such that he did not think them adapted for wool

uses because they had too much of the pungent smell of paraffine oils and too low a boiling point.

Page 42, ints. 13, 14.

And on p. 44, cross-int. 13, he gives as the reason why the pungent smell of the paraffine oils was more objectionable in a wool oil than in a lubricating oil, that "the odor would remain in the goods after the goods were manufactured."

It does not appear even from defendant's evidence that the old paraffine oils were ever used to any considerable extent as wool oils. Some small sales of mixed oils are testified to, but there is no testimony from any one who has used them, and in the only instance in which the dealer has testified as to the material on which they were used, it appears that it was in the manufacture of coarse articles, such as carpets and blankets.

Finally, we have again the testimony of the defendant himself, in the circular issued in 1870, in which he advertises his neutral topaz oil, fully confirming what these witnesses have testified to as to the character of the old oils.

He says: —

"If the combinations (of paraffine and fatty oils) are used in hot weather or in factories where high temperatures prevail, the low evaporating test of paraffine oils leads to many inconveniences, viz., offensive hydrocarbon smell, filling the atmosphere in workshops with combustible gases and vapors, and condensing oily matter on the window panes, frequently affecting the eyes of the operatives. *All these named disadvantages render paraffine oils unsuitable for a great many practical purposes, especially as compounded wool oils and spindle oils.*

"Used as a wool oil it (*i. e.*, Tweddle's Neutral Topaz Oil) does not stain goods and will stand great heat or friction."

Tweddle, p. 450.

Another use to which oil is put is in currying and finishing leather. The record, p. 371 et seq., shows that patents were held by the Lightfoot Currying Oil Co. for the use of paraffine or petroleum oils for this purpose, but that the oils they could procure for finishing purposes were objectionable on account of the odor. These oils were, until after 1868, purchased of Seccomb, Kehew and Thayer.

Of these oils, Toppan, the superintendent of the company says: —

"The odor was also a very serious objection. After the leather was finished, it left an odor which was injurious to the sale of the manufactured stock."

Int. 9, p. 371.

Lightfoot, the treasurer of the company, says: —

"The odor in the finishing oil was objectionable, on account of the smell left upon the leather. Many of the curriers will not use it, up to this time, on account of the odor from the oil."

Page 389, int. 16.

Winn, also a director in the company, testifies to the same effect.

Page 395, cross-int. 8.

The persistent character of the peculiar offensive odor of the paraffine oils is shown by their conduct when mixed with the fatty vegetable or animal oils for lubricating purposes.

Dr. Hayes says: —

"The odors possessed by these oils are persistent, and when mixed with other oils there is an apparent development of the peculiar odors The odors of these oils in mass was not always so offensive as when they were mixed with and diluted by other oils."

Page 73, int. 8.

Squier testifies: —

"*Int.* 11. About what proportion of the paraffine oil you had dealt in prior to Merrill's oil could you mix with fatty oils, without imparting the characteristics of paraffine oil to the compound?

"*Ans.* Not any. A very small quantity of the paraffine oil would impart its characteristics to the other oil. What I mean by 'not any' is, in comparison. We used to use from two to five gallons to a barrel of, say, from forty to forty-five gallons of other oil. Very rarely more than that."

Page 15.

Parks says: —

"We never used over twenty-five per cent and usually about ten per cent of the old paraffine oils, and then we would make an inferior oil. I never considered the oil had much of a character.

"*Int.* 15. How was that compound as to odor?

"*Ans.* Rather repulsive than otherwise."

Page 22.

See also Smith, p. 18, int. 29.

Atwood, p. 28, int. 47.

Upon this subject of the state of the art the defendant has taken a great quantity of testimony which appears to us entirely foreign to any issue in this case. Witnesses are called who have made or sold or used some of the old paraffine oils, but they are not asked what the quality of these oils was as to body, odor, or any of the particulars in which the plaintiff claims they were defective and inferior to the patented improvement. All inquiry on these points appears to have been studiously avoided. What they do testify to is, that they or their customers have used certain of these oils with more or less success as lubricants, and that they prefer particular ones to others, — all of which would be very pertinent if the inquiry were as to which of the old oils was the best, but is of little account in determining what the characteristics of those oils were.

Moreover, by far the greater part of this testimony relates, not to the pure paraffine oils, but to mixtures of those with fatty oils, as for instance "Yeoman's Extra Sperm Lubricating Oil." In most cases the proportions of the mixtures are not given at all, or if given, are stated so loosely and within such wide limits that it is impossible to say how far the qualities of the mixed oil are due to the paraffine and how far to the fatty oils.

Even if it were proved that these mixed oils were free from objection as to body, odor or color, it by no means follows that the paraffine oils which entered into their composition were equally free from objection. Indeed, the only object in mixing the higher-priced, fatty oils with the paraffine oils is to supply, as far as possible, the defects of the latter. If the paraffine oils had been free from objections for lubricating purposes, no one, either dealer or consumer, would have mixed with them sperm or other fatty oils costing from twice to four times as much per gallon as the paraffine oils, as was almost universally done.

Our position is not that the old paraffine oils could not, when mixed with fatty oils, be used in many cases to advantage for lubricating purposes. This we admit. But we do contend, and the defendant's testimony does not militate against the position, that these oils had certain objectionable qualities which prevented their being substituted

for animal or vegetable oils, except to a limited extent, and for some purposes prevented their use altogether.

There is no dispute but that consumers were seeking for an oil free from paraffine odors, and one of sufficient body to take the place of the animal oils, which were then very high in price. Manufacturers were exerting themselves to their utmost, and bringing to bear every resource of the chemist's art to meet this demand, but no one has come forward who had claimed that he has met these requirements. The defendant Yeomans himself admits that he had frequently requested the plaintiff to produce such a deodorized oil, and although he confesses that he wished it for the purpose of deceiving his customers, it is none the less a distinct admission that at that time he knew of no oil in the market possessing these qualities.

See Yeomans, p. 106, int. 29.

The foregoing testimony relates principally to the general character of the old paraffine oils as a class, and comes mainly from the plaintiff's witnesses; but the defendants have seen fit to take a quantity of evidence respecting the merits of certain specific oils, which, from the use they make of them in evidence, we have a right to consider as the best that they could find in the market. A brief examination of these in detail will fully confirm the testimony already cited. The principal of these oils were, besides Downer's and the Maysville oil, which have been already considered, Coffin's, Lincoln's, Seccomb, Kehew & Thayer's, Merriam & Morgan's, and Philbrick & Parson's.

As to Coffin's oil, the defendant Yeomans testifies that it always had a pungent, petroleum smell; that as to odor, it ranked next to Tweddle's and Merrill's, and that the latter possessed an advantage over Coffin's in having no petroleum odor, and amount of freedom from fluorescence.

Page 114, ints. 7, 8, 10.

Again he says that the old Downer paraffine oil was fully equal to Coffin's as to color and odor.

Page 115, int. 19.

As to the price, he testifies that this oil has been about ten cents per gallon less than Tweddle's and Merrill's at the same time.

Coffin himself testifies that this oil was made by the ordinary process of distilling paraffine oils, which he describes.

Pages 111, 112.

Lincoln's oil appears to have been substantially the same as Coffin's. It was made by the ordinary process.

Yeomans, p. 180, int. 3.

It was used by Yeomans and Goss, who are the principal witnesses respecting it, for the same purposes as Coffin's.

Page 180, int. 2.

Goss says that when used in preference to Coffin's, this has been either from an advantage in the terms or a personal preference as between the two manufacturers.

Record, p. 301, int. 25.

Seccomb, Kehew & Thayer's oil was of the "average character of paraffines."

"Had the same odor of the other paraffines that were in the market."

Smith, p. 17, cross-ints. 36, 37.

How nearly it corresponded to the "neutral" oils may be inferred from the language of Mr. Kehew to Mr. Thayer on seeing a samp'e of Tweddle's oil, — that he (Thayer) was "*nowhere in manufacturing oil.*"

Thayer, p. 452, int. 18.

The correctness of his remark we are not inclined to dispute.

The Cleveland oils of Morehouse, Merriam & Co., and Merriam & Morgan, are thus described by Mr. Merrill; —

"I am acquainted with the oil made by Merriam & Morgan It differs from my deodorized oil; first, in having a strong, disagreeable odor; second, in having considerable percentages of thin and volatile oils; and third, in having a deep green and blue shade of color, from which my oil is free. Its price in the market is from thirty-two to thirty-five cents per gallon, whilst the price of my deodorized oil is from fifty to fifty-five cents per gallon."

Page 435.

Peck also testifies that this oil had the same odor as other paraffine oils in the market.

Page 335, ints. 17, 18.

Mr. Merrill has also put in evidence an application from Merriam & Morgan for a license to manufacture under his patent, which proves conclusively that they at least never regarded their oils as the same as his.

Page 436.

As to the Philbrick & Parsons oil, Mr. Philbrick testifies that nearly all was made by the ordinary process of distillation. He says further: —

"It was of a dark yellow color, somewhat brownish. The odor was variable, and that caused us a good deal of annoyance; we couldn't depend on getting it of a uniform odor. It is difficult to describe it. It was an odor peculiar to that product. It was penetrating and peculiar."

Page 311, ints. 5, 6.

This oil was sold at prices considerably under those of the Downer Company.

Page 312, int. 21.

He says also that afterwards a patented apparatus was put up for distilling by superheated steam, but that it proved unmanageable and useless, and was abandoned, less than fifty barrels of lubricating oil having been made with it.

Page 313, ints. 25, 26.

This product, he says, compared favorably as regarded odor and color with Downer's old paraffine oil, but was not of so good a body.

Page 312, int. 20.

Of Merrill's oil, he says: —

"I think the odor and color are superior to anything we made. The body appears to be better also."

Page 312, int. 22.

VII.

Merrill's Deodorized Oil.

The plaintiff's invention, as claimed in his patent, consists of the "described manufacture of deodorized heavy hydrocarbon oils, suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from heavy hydrocarbon oils, by treating them substantially as described."

The circumstances under which Merrill made his invention, and the steps which he took to perfect it, are detailed by him in his evidence as follows: —

"On the 29th day of November, 1867, I first had my attention called to the deodorized oil, which was occasioned by an accident happening to the distilling apparatus, while performing distillation upon an oil known as No. 2 oil, which was an oil too heavy for illuminating purposes and too light for lubricating purposes, and was being distilled for the purpose of separating, in the usual manner, the heavy and light oils existing in the No. 2 oil. The still was loaded with the No. 2 oil, and fired as usual; but after the oil began to run from the condenser, it became evident that this condenser was partially closed, as a considerable pressure was created upon the still; so much so as to cause it to leak slightly at the bottom joint. The obstruction in the condenser seemed to increase the pressure, and we were obliged to slow down the fire to relieve it. We continued the distillation

with a slow fire, in hopes to run off the charge from the still; but the obstruction increased so much in the condenser as to necessitate the withdrawal of the fire from under the still, to relieve the pressure, which was so great as to create quite a serious fire from the leakage of the oil down into the fire from the joint. The still contained, when first filled, about nine hundred gallons of the No. 2 oil. We had distilled over, through the condenser, about two hundred and fifty gallons at the time we were obliged to withdraw the fire. The next day, the 30th of November, the oil left in the still had cooled sufficiently to safely permit the removal of the manplate for the purpose of removing the oil from the still. I noticed that the oil remaining in the still was unlike any oil I ever before saw. It was of a good yellow color, very odorless, and neutral in smell, and oily in body; and I reasoned that the removal of the light oils that were in the No. 2 oil was one of the causes of its neutrality and freedom from odor and increased body, and that the yellow color was due to the fact that we had been obliged to use a very moderate fire in distilling over the portion that had been distilled over. I saved samples of the oil, and showed them to members of our company, and they were as much impressed with the quality, in respect to the peculiarities mentioned, as myself. I began experimenting upon various heavy oils in my laboratory, for the purpose of verifying my theory in regard to the neutrality and body of the oil as found in the still, as described. I made many experiments, distilling mostly in glass retorts, during the month of December following, to ascertain the amount of distillate necessary to be removed to produce an article at once free from odor, oily in body, and of good color; distilling from our regular machinery or lubricating oil, various percentages, from ten to thirty, and with varying intensities of flame, from very slow to quite rapid. Having satisfied myself about the quantity necessary to be removed, I began distilling the oil in an iron still of a capacity of about 50 gallons. Having here larger quantities to work with, I began a series of experiments to ascertain the gravity of the oils distilling over from the lubricating oil and what point of gravity it was necessary to reach to make an oil deodorized and of good body and color. I ascertained that when I distilled off that portion of the oil which came over to the condenser, until the distillate reached the gravity of thirty-six degrees Baumé, the oil remaining back in the distilling apparatus was so entirely changed in odor and body as to constitute a new article in the trade, it having only a slight smell, more like a sweet, fatty oil, and entirely different from the characteristic odor of the paraffine oils, as before manufactured; but I found the oil was rendered more oleaginous, and in some respects improved, by continuing the distillation until the oil remaining from the condenser had a gravity of thirty-two degrees Baumé. This occupied nearly the entire months of December and January. After ascertaining just what was required to produce my deodorized oil, I began its practical manufacture in a two-hundred-gallon still, and when a sufficient quantity had been made, offered it to the trade as an article of commerce."

Page 51.

The process described in Merrill's patent is substantially the same as that indicated by these experiments. He there says:—

"To make heavy hydrocarbon oils, free from the characteristic unpleasant odors of heavy hydrocarbon oils, I take the heavy oils which have been separated from the lighter oils and from mechanical impurities by distillation, and after chilling and expressing the solid paraffine, when such operation is necessary, place them in a still heated by a fire underneath, and slowly and gradually raise the temperature until from ten to thirty per cent of the contents of the still are distilled over, when the still is cooled down and the remaining contents removed.

"The matters which go over to the condenser have a very foul, offensive and disgusting odor; but the oil remaining in the still, if the operation has been properly conducted, is free from the characteristic offensive odor of hydrocarbon oils, and has no smell except a slight odor similar to that of fatty oils."

Pages 7, 8.

After specifying the extent to which the distillation should be carried, he then says: —

"I do not assume to know the reason why the above-described process produces heavy oils, free from the characteristic odors of hydrocarbon oils, but suppose that these odors arise from matters resulting from decomposition at the temperature at which the heavy oils vaporize and go over, and that these matters, after they are condensed with the heavy oils, will vaporize at a temperature lower than that required to vaporize and distil over the heavy oils, and, therefore, may be separated from the heavy oils by distillation in a close still, at a temperature below that required to distil over the heavy oil, which, not being vaporized, will remain free from the odorous matters which would result from decomposition at the temperature required to vaporize it and distil it over."

Page 8

And again, after describing some modifications of the process and of the means of carrying them out, he says: —

"From the above, it will be obvious that my invention consists in producing heavy hydrocarbon oils, suitable for lubricating and other purposes, and free from the characteristic odors of heavy hydrocarbon oils, from heavy hydrocarbon oils, by distilling from them the volatile matters from which the objectionable odors arise, and at the same time preventing new formations of such matters by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil."

Page 10.

Merrill succeeded in removing from the heavy oils the light oils or volatile bodies, which were always before associated with them, without at the same time decomposing the heavy oils, so as to form new, light bodies; and when he had done this, he found that the

heavy oils possessed qualities not before known. They were found to be much more oily than before, and even when of lighter gravity to have a higher degree of the consistency which is called body, and which adds greatly to the value of an oil as a lubricator.

They were also found to be practically free from the offensive odors which had always characterized the paraffine oils, and to have a much higher boiling point than before; and it was found as a consequence, that they did not readily evaporate, either from a mass, or when spread on bearings and subjected to the action of moving surfaces.

It was, indeed, known prior to this time that some thin, volatile oils were associated with the heavy hydrocarbon oils; and Atwood speaks of having directed his attention to their removal in the manufacture of the Portland oil, with the view of improving the body of the oil.

Page 31, int. 64.

But it seems never to have occurred to him or to any other manufacturer that the characteristic odor of the paraffine oils was due to the light volatile oils with which they were associated. On this point Merrill's testimony is very positive. He says: —

"In my own experience, as a manufacturer of hydrocarbon oils, I never have seen anything that would occasion the belief, or suggestion even, that the odors peculiar to heavy carbon oils, as made before my discovery, were due to the light, more volatile oils with which they are associated, and in all my intercourse with other manufacturers of hydrocarbon oils I never heard the subject alluded to in that connection; but I have always entertained a belief that the heavy hydrocarbon oils had a characteristic odor peculiar to themselves, which, like that of sperm, whale, or other fatty oils, might be readily distinguished and ascertained; but since my discovery, I know I can manufacture a heavy hydrocarbon oil as free from odor and taste as paraffine was itself; and paraffine is as odorless as granite."

Page 52, int. 13.

The character of these odorous volatile matters is shown by Prof. Silliman, by mixing small percentages of them with sperm, lard and other oils. Four per cent of this volatile matter added to the latter oils completely disguised their characteristic odor. Two per cent added to Merrill's oil produced a mixture whose odor was iden-

tical in character and apparently about equal in intensity to that of the original volatile oil.

Silliman, p. 88, int. 6.

In respect to their boiling points, the difference between the old paraffine oils and Merrill's is very marked. The boiling point of the latter is from 150° to 200° higher than the Portland oil, which is shown by the record to have been one of the very best paraffine oils in the market at the date of Merrill's invention. The boiling point of the Merrill oil is 600°; of the Portland from 425° to 450°.

Atwood, p. 39, cross-int. 65.

A further series of experiments conducted by Mr. Atwood with reference to the amount of volatile matter in the respective oils gave as the amount of such volatile matter distilled under 600° from Merrill's oil, of a gravity of 30¾ degrees, one half of one per cent; and from the Portland oil, of a gravity of 27¼, four and one tenth per cent.

Atwood, p. 365, cross-int. 10.
" " 368, " 33.

In these experiments the distillation commenced in Merrill's oil at 600°; in the Portland oil at 455°.

Page 369, int. 5.

The results of these experiments are exceedingly important.

In the first place the great difference between the boiling points of the two oils indicates a corresponding difference in their composition and structure, scarcely less marked than that between the paraffine oils and kerosene.

And in the second place the difference in the amount of volatile distillate from the respective oils confirms the statements of Mer-

rill's patent, that the old oils were mixtures of heavy oils with light volatile bodies, while it proves at the same time that his oil is a homogeneous product, substantially free from these volatile ingredients.

But the high boiling point of Merrill's oil is not merely a mark of distinction between this oil and the others. It is in itself a valuable quality. When used in warm rooms, as in woollen factories, the old oils, having low boiling points, gave forth odorous vapors at comparatively low temperatures, which rendered them very objectionable in such situations.

On the other hand, the high boiling point of Merrill's oil prevents its being affected by ordinary temperatures, and enables it to be used in places where no other paraffine oil could be employed.

The process of removing the offensive odors produced also a great improvement in the body of the oil, and consequently in its lubricating qualities. The light volatile oils above referred to not only tainted with their peculiar, offensive odor the whole mass of the heavy oil, but diluted it and diminished its oleaginous properties. Consequently their removal left the heavy oil in a state of purity, and of much greater consistency, tenacity, and viscidity than before.

Merrill, p. 67, cross-int. 46.

The result of these processes was the patented oil, an article free from odor, oleaginous in body, light in color, free from fluorescence, and in every respect so unlike the paraffine oils then known that

It was not merely a better quality of paraffine oil differing from that before known only in the degree of odor, color, etc., but a new composition of matter, distinguished from the old oils by the absence of some of their characteristic elements, namely, the light odorous bodies always found in them.

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Merrill, p. 67, cross-int. 46.

The result of these processes was the patented oil, an article free from odor, oleaginous in body, light in color, free from fluorescence, and in every respect so unlike the paraffine oils then known that Merrill tells us that an English oil-dealer to whom he showed it disputed its being a hydrocarbon oil until convinced, by the application of tests, that such was the fact.

Merrill, p. 51, int. 11.

Novelty and Utility of the Invention.

In support of the novelty and utility of the patented oil as an article of manufacture, the testimony is overwhelming. Not only do the plaintiff's witnesses of all classes agree on these points, but, what is very remarkable in a suit as closely contested as this, their evidence is not contradicted by the witnesses for the defence. As to the respective merits of the old oils, there is indeed considerable difference of opinion; but defendant has not dared to ask one of his witnesses, though many of them were shown to be experts, whether in their judgment Merrill's oil was a new article, as compared with the paraffine oils formerly made.

The elements of novelty in Merrill's oil are thus pointed out by Mr. Atwood, the superintendent of the Portland Oil Works, and a manufacturer of paraffine lubricating oils. : —

"Its most essential points of difference are, first, its high boiling point when compared with other oils; its light specific gravity when compared with other oils having sufficient body to be used as lubricators; the almost entire absence of volatile oil; its greater freedom from odor and color."

Page 32, int. 72.

As to the novelty of the invention, he testifies directly as follows: —

"*Int.* 74. As a person skilled in the manufacture of oils, do you regard the production of this oil as an important improvement in the art?

"*Ans.* I do in several points First, it accomplished the removal of the volatile bodies, which I had sought in vain to remove. It also deodorized the oil, as well as very greatly increased the quantity that could be made from the crude oil used."

Page 32.

S. Dana Hayes, a chemical expert, and formerly also a manufacturer of petroleum oils, testifies substantially to the same effect. Comparing the oils made by Merrill with those previously in the market, he says: —

"They are far superior for the purposes for which they are intended. They differ essentially in the absence of odor, comparative absence of color, absence of taste,

absence of light oils, and in their lubricating qualities. They belong to a different commercial class of oils."

Page 73, int. 11.

The testimony of these witnesses shows that the patented oil differs from the others in almost if not quite every quality by which we practically distinguish one animal oil from another or from a petroleum oil, as articles of commerce, viz., in color, taste, smell, specific gravity and lubricating qualities.

The testimony of dealers and consumers of lubricating oils is equally positive as to the improved character of the patented oil and its novelty as an article of manufacture.

Five extensive dealers in paraffine oils, whose business required them to be thoroughly informed as to the different kinds of oil in the market, testify explicitly that, prior to Merrill's invention, they had seen no oil in the market resembling his in body, color, and freedom from odor.

Smith, p. 14, int. 20.
Squier, p. 19, int. 17.
Parks, p. 23, int. 16.
Maguire, p. 42, int. 16.
Treat, p. 47, int. 22.

Both Smith and Squier also testify that they considered it as an entirely new article.

Smith, p. 14, int. 21.
Squier, p. 20, int. 20.

In this opinion they are supported by the defendant Yeomans, who testifies as follows: —

"*Cross-Int.* 51. When Mr. Joshua Merrill first talked with you about his oil, or at some time subsequent to that, did you not tell him that the oil was entirely different from any oil you had seen before, and that it was a new article?

"*Ans.* I do not remember stating it to him in those words. I remember telling him that it was superior to anything of the paraffine oil nature that I had ever seen before.

"*Cross-Int.* 52. Did you not say to him substantially what I asked you in the preceding question?

"*Ans.* Well, it may have been substantially so. *It was different and it was new*; and I told him it was superior, as I said before, to any other paraffine oil that I knew of."

Page 108.

In regard to odor and body, the following witnesses, dealers in paraffine oils, testify to more or less complaint from their customers as to the old oils, but that there has been no complaint of Merrill's oil in either of these respects.

Smith, p. 14, int. 17; p. 16, cross-int. 24.
Squier, p. 19, ints. 15, 16.
Parks, p. 22, int. 11.
Treat, p. 46, int. 16.

To the same effect is the testimony of the following witnesses, agents of some of the largest cotton mills in New England, who testify from actual experince with this oil.

Cumnock, p. 95, ints. 13, 14.
Shove, p. 323, int. 17.
Durfee, p. 325, int. 10.
Shaw, p. 321, int. 13.

The last-named witness says, "As to odor, I should not know it was in the mill."

As to its lubricating properties, the oil dealers testify that a considerable proportion of their sales are of pure oil, and that many of their customers use it unmixed, especially on spindles, with good success.

Smith, p. 16, cross-int. 23.
Squier, p. 19, ints. 12, 13.
Parks, p. 22, int. 12.
Treat, p. 47, cross-int. 3.

A number of mill agents and others also testify to having used this oil as a lubricator, either pure or mixed, with a small percentage of sperm oil, and in each instance with favorable results.

Cumnock, agent of the Boott Mills, uses Merrill's oil mixed with sperm on the cotton machinery, in some places half and half, in others one third sperm. On the shafting he uses the Merrill oil pure, and finds it much superior in body and odor to the old oils.

Page 94, int. 8.

Shaw, agent of the Tremont and Suffolk Mills, running 84,000 spindles, at first used Merrill's oil and sperm half and half, then three to one, and afterwards Merrill's pure, but thought the pure oil "did not work quite as well." Has given good satisfaction.

Page 321, int. 13.

Durfee, agent of Mechanics' and Troy Mills, running together about 93,000 spindles, has used Merrill's, mixed with sperm, in the proportion of four to one, till within sixty days, since which time he has used Merrill's pure. "Have always been entirely satisfied with its durability and economy."

Page 325, int. 6.

Tripp, builder of hot-air engines, uses on his engines Merrill's oil and sperm in proportion of five to one; has tried other paraffine oils, but found nothing else, but pure sperm, which would answer the purpose; on machinery uses Merrill's oil pure.

Page 315, ints. 9 – 15.

Pierce runs a planing-mill with a large quantity of wood-working machinery. Uses Merrill oil unmixed; considers it a perfect lubricator.

Page 315, ints. 9, 14.

As a wool oil, Maguire says he has used Merrill's oil mixed with fatty oils in the proportion of three to one with satisfactory results; did not consider other paraffine oils adapted for this purpose.

Page 42, ints. 10 – 13.

Treat also testifies that his customers prefer "Maguire's Wool Oil" made as above to pure olive oil.

Page 47, int. 21.

As to staining goods in process of manufacture, none of these witnesses have experienced any difficulty since using Merrill's oils, though previously complaints on this subject were frequent.

Squier, p. 19, int. 15.
Maguire, p. 44, cross-int. 17.
Cumnock, p. 95, int. 15.
Shaw, p. 321, int. 13.
Shove, p. 323, int. 18.
Durfee, p. 325, int. 6.

A remarkable proof of the neutral character of Merrill's oil, and of its freedom from the peculiar, persistent odors which characterize other paraffine oils, is shown by its conduct when mixed with fatty oils, but a small proportion of the latter being required to impart to the mixture their own peculiar smell. When mixed with the common fatty oils in the proportion of two-thirds of the Merrill oil to one-third of the fatty oil, the slight odor of Merrill's oil is entirely covered up by the odor of the fatty oil. In the case of sperm, whale and olive oils, the same effect is produced by a mixture of four parts Merrill's oil to one of either of these oils.

Merrill, p. 55, int. 23.

To illustrate this point, a series of mixtures of each of the following fatty oils, viz., sperm, castor, cotton-seed, poppy, almond, olive and lard, with Merrill's oil, was made by Prof. Silliman in the proportion of one-third of the former to two-thirds of the latter. "In all these cases," he says, "the falsification was complete, the characteristic odor and appearance of the falsified oils being preserved in the mixture." A further series of mixtures was also made by adding to a four-ounce bottle of Merrill's oil three or four drops

of oil of anise, oil of cassia, etc., the mixture in each case assuming the odor of the minute quantity of aromatic oil, and producing a good falsification of that oil.

Silliman, p. 88, int. 6.

These results are confirmed by the practical experience of dealers in mixing oils for lubricating purposes.

Smith says that when Merrill's oil and a fatty oil are mixed in the proportion of three parts of the former to one of the latter, the mixture is characterized by the smell and appearance of the fatty oil entirely.

Page 17, int. 26.

Squire says, seventy to eighty per cent of Merrill's oil can be mixed with fatty oil without imparting any odor to the latter.

Page 19, int. 14.

Parks uses from thirty to sixty-five per cent of the Merrill oil with the same result. He says: —

"We think a man must be an expert to detect the combination from the fatty oil itself. No ordinary man using it can distinguish it from the natural oils when we use thirty per cent of it.

Page 22, ints. 12, 13.

Maguire says that in mixing in the proportion of three-fourths Merrill oil to one-fourth fatty oil for use on wool, the mixture will assume the odor and color of the fatty oil.

An infallible proof of the inferior quality of the old oils, as compared with Merrill's, is furnished by a comparison of the prices which these oils respectively bore in the market, as shown by the following table compiled from the record.

COMPARATIVE PRICES OF OILS.

	1868.	1869.	1870.	1871.
Sperm . . .	$2.11	$1 92	$1.52	$1.25
Merrill's . . .	50 – 60 c.	70 – 75 c.	55 – 60 c.	55 – 60 c.
" unbleached .		55 – 60		
Coffin's, . .	39		34 – 40	34 – 40
Russell & Moore's .		45		
Lincoln's . . .			35	35
Richardson's . .			40	
Reed's . . .			40	
Libby & Clark's . .			25 – 30	
Seccomb, K. & T.'s .			40	
Merriam & Morgan's .				32 – 35

The evidence as to the prices of the respective oils referred to in the above table will be found in the record as follows: —

Sperm — Southard, p. 303; Merrill, p. 53.
Merrill's — Merrill, p. 60, 435; Treat, 304.
Coffin's — Merrill, p. 60; Clark, p. 146; Coffin, 113.
Russell & Moore's — Wattles, p. 148.
Lincoln's — Goss, p. 302; Merrill, p. 60.
Richardson's — Merrill, p. 60.
Reed's — Merrill, p. 60.
Libby & Clark's — Goss, p. 302; Merrill, p. 60.
Seccomb, K. & T.'s — Thayer, p. 182.
Merriam & Morgan's — Merrill, p. 435.

Peck, who was the selling agent of the last-named oil in the West, says that from 1868 to 1870 the price varied from forty to forty-five cents.

Peck, p. 339.

There is also testimony that in small lots this oil was sometimes sold as high as fifty cents, and in one instance fifty-two cents; but these were exceptional cases, and the table is based on the wholesale prices.

The light-colored paraffine oils sold by Seccomb, Kehew & Thayer to the Lightfoot Company, for currying purposes, from 1868 to 1872, averaged from thirty-four to forty-two cents.

Winn, p. 396.

The Portland oil, from 1868 to 1870, averaged from forty to fifty cents.

These figures show that since Merrill's oil has been in the market, it has uniformly brought from ten to thirty cents per gallon, or from twenty to fifty per cent more than any paraffine oil in the market except Tweddle's neutral topaz oil.

This proves conclusively that the defects in the old oils, pointed out in the testimony already cited, were not imaginary or of trifling importance and that the improvement made by Merrill in these respects was a substantial one in respect to the value of the oils for practical purposes. In no other way can this difference in price be accounted for.

VIII.

Infringement.

The act of infringement relied on by the plaintiff is the sale by the defendants of an article called "Tweddle's Neutral Topaz Oil," manufactured by Dr. H. W. C. Tweddle, of Pittsburg, Pa.

The fact of the sale is proved by the testimony of Dickerman, who purchased a barrel of the oil of the defendants, Feb. 14, 1870.

Dickerman, p. 11.

And is confirmed by the testimony of the defendant Yeomans, who admits having sold five or six hundred barrels prior to Jan. 18, 1871.

Yeomans, p. 110, cross-int. 71.

There remains, then, only the question whether the oil thus sold was substantially the same as that patented to the plaintiff.

On this point the finding of the Court below was in favor of the complainant.

The learned judge says, in his opinion: —

"The neutral topaz oil is abundantly proved to possess many characteristic properties in common with those peculiar to Merrill's oil, and which distinguished Merrill's oil from the lubricating paraffine oils which had preceded it.

"The two oils have substantially the same density and odor, the same amount of lubricating quality, the same freedom from the offensive odors of petroleum distillates. In both the boiling point was from 150° to 200° higher temperature than the boiling point of the best of the other hydrocarbon heavy oils."

Record, p. 554.

We present a brief statement of the evidence on which this finding was based.

That the two oils are substantially the same we shall show, first, by a comparison of the oils themselves with reference to their chem-

ical constitution and commercial properties; and, second, by a comparison of the respective processes by which they are made.

As to the first point, Dr. Hayes testifies to the substantial identity of the plaintiff's and the defendants' oils as follows (p. 74) : —

"I have made very careful examination of these samples [of Tweddle's oil], and have compared them with the oil made at the Downer Kerosene-Oil Works, and with that made by myself when following the directions given in Merrill's patent; and have also compared them with other hydrocarbon oils in the market. These samples possessed all the qualities described in Merrill's patent. They are very nearly identical with the oil made at the Downer Kerosene-Oil Works and with that which I made. *They are substantially the same, but differ greatly from any other hydrocarbon oils known in the arts.* These specimens and those manufactured as stated above, correspond and agree very closely in the following physical characters, which are the only characters of importance in commerce and in the arts: first, absence of offensive odors; second, absence of opalescence, fluorescence, or the presence of blue or green tints; third, absence of taste; fourth, absence of light hydrocarbons; fifth, in mixing qualities; sixth, in lubricating qualities; seventh, in density; eighth, in boiling points; ninth, in absence of chemicals. I attach most and greatest importance to their similarity in absence of odor, opalescence and taste. *In these respects they differ greatly from any other oils in the market, and form a new commercial class of oils.* These characteristics enable them to be used where hydrocarbon oils, as previously made, could not have been used, in the arts. These specimens and those manufactured as above stated are substantially the same, and very different from other petroleum oils.

"*Int.* 16. When you say that you attach most importance to the absence of odor, opalescence and taste, do you mean that you attach most importance to them as indicating that the two oils are substantially alike, or that these qualities of themselves are of greater importance than the others in their commercial character?

"*Ans.* I attach greatest importance to these characteristics as establishing the difference between these and other oils, also as showing their similarity. At the same time they are highly valued characteristics in commerce, but would be of little importance if the oils did not possess other qualities which I have mentioned.

"*Int.* 17. As to the absence of opalescence in these samples, as compared with the oil which you obtained when repeating the process described in Merrill's patent, which do you find to be the most free from the green and blue tints?

"*Ans.* Neither of these oils is absolutely free from opalescence, but that taken from the barrel is freer from it than what I manufactured. Both differ greatly in this respect from other petroleum oils in commerce.

"*Int.* 18. As to the absence of odor and taste, how did the samples of the defendants' oil differ from that made by you or from that manufactured at the Downer works?

"*Ans.* In regard to odor and taste I have been unable to detect any appreciable difference between them, by the most delicate tests that have occurred to me; and

I have tried a great many tests upon them. If there is any difference, the oil which I made is a little better than the others in these characters.

"*Int.* 19. You speak of their mixing qualities. Will you explain a little more what you mean in that respect, and how they compared with each other? Which was the better in that respect?

"*Ans.* By mixing qualities I mean, that when these oils are mixed with others, fatty or animal oils, for instance, their peculiar characteristics of color, odor and taste are lost, and disguised by the animal oils. With regard to mixing qualities, there is very little if any difference. There is no material difference. They are substantially the same.

"*Int.* 20. You speak of the absence of the light hydrocarbons as one feature in which the oils compared resemble each other. Was there any difference in this respect in the oils? If so, which one was the purest from these? What means did you take for ascertaining this fact?

"*Ans.* There were very slight differences. The sample that I made myself, being rather freer from light oils than the others, and that made at the Downer Kerosene-Oil Works, containing a very little less than defendants'. The absence of light hydrocarbons was determined by heating these oils, at different temperatures, in glass retorts, and determining the proportion of light hydrocarbons that would separate from them, and great care is necessary and was exercised in these determinations. Differently shaped retorts would yield different results, but these comparisons of the oils were always made in the same apparatus.

"*Int.* 21. How did these oils correspond in density and boiling points?

"*Ans.* The correspondence is not so close in these respects. Both of these oils are lighter in density than others in the market, and they both boil at higher temperatures than others in the market. The oil made at the Downer Kerosene-Oil Works has a density of twenty-nine and eight-tenths degrees Baumé. The oil that I made has a density from thirty and eight-tenths to thirty-one and four-tenths degrees Baumé. The sample from the barrel has a density of thirty-four and eight-tenths degrees Baumé. The boiling point of Merrill's oil, as made at the works, is six hundred degrees Fahrenheit. The boiling point of the oil taken from the barrel is five hundred eighty-five degrees. I have not determined exactly the boiling point of the oil made by me, but know it to be above five hundred and eighty degrees."

Prof. Silliman testifies as follows as to the character of the defendants' oil, and its identity with the plaintiff's: —

"I have had two samples purporting to be sold by the defendants. One of them was handed to me by Mr. Joshua Merrill, in July last, if I remember correctly. Another, taken by my colleague in this case, Dr. Chandler, from a cask in possession of the plaintiff in this case, bearing the trade mark of Dr. Tweddle, the reputed manufacturer. These two samples are identical in physical and chemical properties. Their density at sixty degrees Fahrenheit is thirty-five degrees Baumé. Both are neutral, in the commercial sense of that term, meaning that they are sensibly without odor or taste."

Page 89, int. 7.

"*Int.* 10. How did the samples, which you had of the defendants' oil, correspond with the oil described in Merrill's patent as his new oil? How far do you find the two to be alike substantially, or unlike?

"*Ans.* I found as the result of my own experiments in the analysis and comparison of these two oils that they were substantially identical. The density of the defendants' oil is, by the hydrometer, a little less than that of the plaintiff's oil.

Int. 11. You have spoken of the defendants' oil being neutral to taste and smell. If you made any experiments to ascertain its behavior when mixed with such lubricating oils as sperm and lard oil, will you state how it compares substantially, when tested in that way, with the oil produced in the manner described in Merrill's patent?

"*Ans.* I have made a duplicate series of the same mixtures of animal and vegetable oils, and of essential oils, using the defendants' oil as the substratum, similar in all respects to the series which I have already enumerated in my answer to the sixth interrogatory; and I believe that no person, however expert he may be in the recognition of mixtures and falsifications of oils, could, without reference to the labels attached to those two series of samples, distinguish the one series from the other. They are, as it appears to me, entirely identical."

Page 90.

The similarity of the two oils as to their boiling points and the character of the volatile product distilled from them is further shown by the experiments of Mr. Atwood, described on pages 561–2 and 569 of the record. On the latter page Mr. Atwood testifies as follows: —

"*Int.* 5. At what several points of temperature did the distillation of vapor commence in the Merrill oil, Tweddle oil, and Portland oils, respectively, which were the subjects of the experiments referred to in your cross-examination?

"*Ans.* Merrill's oil commenced at six hundred degrees. Tweddle's topaz oil at five hundred and fifteen degrees. Portland oil at four hundred and fifty-five degrees.

"*Int.* 6. What were the gravities of these oils before they were subjected to the experiments?

"*Ans.* Merrill's oil was at 60 F. — 30¾° Baumé.
Tweddle's " " 35° Baumé.
Portland Manuf. oil " 27¼° Baumé.

"*Int.* 7. How were the gravities of the residuums effected by distilling off the quantities which you have mentioned in your cross-examination?

"*Ans.* The gravity of the residue was raised in all cases.

"*Int.* 8. Relatively to each other, then, how much were they raised?

"*Ans.* Merrill's oil was raised sixteen one-hundredths of one degree; Tweddle's twenty-six one-hundredths, Portland machinery oil, sixty one-hundredths of one degree.

"*Int.* 9. What do these conditions of gravity, and the points at which distillation

commenced, indicate as to the character of what was distilled over, compared to the oil which was the subject of distillation?

"*Ans.* They indicate that those oils commencing to distil over a high temperature are more nearly like the product distilled. Or, in other words, those having high boiling points did not contain any volatile oils, or, if any, but very little, ready formed."

"*Cross Int.* 1. At what points of temperature, respectively, did the three oils last referred to yield vapors which condensed on the sides of the retort?

"*Ans.* Merrill's oil, at 330° F.
Tweddle's " 320° F.
Portland " 330° F.

"*Cross-Int.* 2. What do you mean by your last answer (direct) by volatile oils 'ready formed'?

"*Ans.* I meant oils ready formed, of low boiling point, as compared with the mass of the oil composing the sample. That is, by ready formed volatile oils, I meant oils having a low boiling point, but mixed and held in solution by a large quantity of oils having a high boiling point, in distinction from oils obtained from those having a high boiling point by distillation, and changed at the same time to those of low boiling point, and differing from the oil from which they were derived.

"*Cross-Int.* 3. Then you mean by 'ready formed volatile oils' oils which are distilled in vapor without undergoing cracking?

"*Ans.* I do."

The plaintiff, Mr. Merrill, after testifiying that he was first shown a sample of Tweddle's oil by the defendant Yeomans, says:—

"I subjected the sample to careful examination, first taking its specific gravity, then testing it on a friction test known as McNaught's machine, with a view to ascertain its body or oily character, and then distilled a sample of it in a glass retort, to ascertain if any thin volatile oils were associated with it, and to what extent. I found upon distillation that the oil contained a small percentage of a light colored oil, but which was of an oily character when rubbed between the thumb and finger, and in that respect very like my own oil, and totally unlike the ordinary paraffine oils in the market. Its gravity was about thirty-four degrees Baumé at sixty degrees Fahrenheit. It weighed eighteen degrees, McNaught's test, when the ordinary paraffine oils weighed much less; my own oils testing by that instrument twenty-two degrees. In short, its general appearance and characteristics so closely resembled my deodorized oil that I was confirmed in my opinion of its being an infringement of my patents, and so informed Mr Yeomans."

Page 53, int. 18.

And again on p. 54, int. 21, he says with reference to its mixing qualities:—

"I did make experiments, several times repeated, of the mixture of fatty oils with the Tweddle oil, and I found that a small quantity of fatty oil, only, was re-

* We desire to add a few words of explanation as to the bearing of the experiments above referred to.

It will be observed that the samples of the oils experimented upon differed considerably in respect to specific gravity,—the Portland oil being $27\frac{1}{4}°$ Baumé, Merrill's $30\frac{3}{4}°$, and Tweddle's 35°, each of the oils in the order named being about four degrees lighter than the one preceding.

Now if these were all homogeneous oils, their boiling points should correspond to their specific gravity, and Tweddle's being the lightest should boil first, Merrill's next, and the Portland oil last. But experiment proved that the Portland oil though the heaviest had the lowest boiling point, viz., 455°, showing that it was a mixture of light and heavy oils, and that the former were of much less specific gravity than the mass of the oil, and boil at comparatively low temperatures.

Tweddle's oil on the other hand did not boil below 515° and Merrill's not below 600°, their boiling points corresponding to the difference in gravity, as would be the case if they were homogeneous and not mixtures of light and heavy oils.

Again, in the experiments referred to, the distillation of each of the oils was continued until a heat of 600° was reached.

At this point $4\frac{1}{10}$ per cent had distilled from the Portland, raising the gravity of the residuum $\frac{60}{100}$ of one degree; while in Tweddle's oil, although 4 per cent was distilled off, the gravity of the residuum was raised only $\frac{26}{100}$, less than half as much; and in Merrill's, which only commenced boiling at 600°, only $\frac{5}{10}$ of one per cent was distilled off, raising the gravity of the residuum $\frac{16}{100}$ of one per cent.

The difference in the effect produced upon the residuum of the Portland and Tweddle oils respectively confirms the previous conclusion as to the difference of the constitution of the two oils.

The Portland oil being a mixture of heavy oils with light volatile bodies, the latter were the first to distil, leaving behind the heavy oils which were of much greater gravity than the mixture before distillation.

Were the Tweddle oil a similar mixture the removal of the same amount of distillate would be attended with a similar increase in the gravity of the residuum. But the experiment proved that while

nearly the same amount of distillate was removed in the two cases before reaching 600° Fahrenheit the gravity of the residuum of the Tweddle oil was increased less than half as much as that of the Portland oil. This proved conclusively that the distillate in the former case was much more nearly like the original oil than in the latter; in other words, that the heat had simply driven off some of the volatile oils existing in the Portland oil, while in the Tweddle oil, which began to boil only at a much higher temperature, it had produced a breaking up and partial distillation of the heavy oil itself.

The same is true in comparing the Merrill oil with the Portland, the high boiling point of the former making the distinction still more marked.

Mr. Atwood's statement that he found none of the volatile oils either in the Merrill or the Tweddle oil should be deemed conclusive on this point.

His testimony on this as well as all other questions is, we submit, entitled to the highest confidence, since his long experience in the practical manufacture of petroleum oils, not only enabled him to perform his experiments accurately and under the proper conditions, but eminently qualified to interpret their bearing on the questions in issue.

It may, however, be asked, why if the Merrill and Tweddle oils are homogeneous, the removal of a portion of the oil by distillation should increase the gravity of the residuum.

The explanation is found in Mr. Atwood's testimony, pp. 368, 369; viz., that all oils having high boiling points have a considerable tendency to change when volatilized, and that the vapors from these oils condense to a greater or less extent in the top of the still and undergo a double process of distillation, in which the constituent elements of the oils become rearranged, resulting in the production of a distillate of lighter gravity than the original oil, and leaving the residuum somewhat heavier than before.

The Tweddle oil being of lighter gravity than Merrill's, it volatilized at a lower temperature; and as the boiling was continued till the temperature reached 600°, consequently both the amount of distillate and the change in the residuum were greater than in Merrill's, but not sufficiently so to show any substantial difference in the constitution of the two oils.

This difference in the gravity of the Merrill and Tweddle oils of itself is immaterial. Both Merrill's patent and Tweddle's recognize the fact that within certain limits these oils may be made of varying degrees of gravity without essential difference in character, provided care be taken that none of the objectionable volatile and odorous oils be allowed to remain in them.

It is only when taken in connection with other characteristics of the oils that their gravity becomes an important means of identifying and distinguishing them.

quired, usually not exceeding one quarter part, to give the odor and general characteristics of the fatty oil to the mixture; but I found that somewhat larger percentages of fatty oil were required to give a body or oleaginous character to the mixture than was the case when using my own oil."

Merrill also testifies to the following significant statement by the defendant Yeomans, at the time the latter first showed him Tweddle's oil: —

"There was conversation took place between us, and *Mr. Yeomans told me that the oil more closely resembled mine than any oil he had ever seen, and that he believed it was an infringement of my patent*, for I had often told him that I claimed a deodorized heavy hydrocarbon oil as a new product."

Page 53, int. 17.

And the truth of Merrill's account is admitted by Yeomans in his testimony, p. 104, int. 12.

This piece of evidence should be conclusive of this point in the present case. Yeomans was then, and had for some time been, a dealer in paraffine oils; was acquainted with the other oils then in the market; and had bought and sold the plaintiff's oil. He was well qualified to judge of the identity of the two oils as articles of commerce, and had no motive to decide in favor of one rather than the other. In a suit against him for infringement, this admission should carry with it more weight than the testimony of any other witness.

The similarity of the two oils as to their peculiar neutral smell is also distinctly admitted by Mr. Yeomans, p. 104, int. 7, as follows:

"*Int.* 7. Which had the less petroleum odor, if either?

"*Ans.* I don't think either had any of the odor of petroleum.

"*Int.* 8. Had either of them any distinctive smell more strongly than the other?

"*Ans.* The Tweddle oil had more of an odor. I couldn't call it distinctive, because I couldn't classify it. It was a peculiar sweet odor. I can hardly describe it."

To the same effect also is the testimony of Mr. Peck.

Speaking of samples of the plaintiff's oil as compared with defendants', he says: —

"They were freer from odor. That was the only difference I could discover. The doctor's oil, after being corked, would, when the cork was removed, emit a slight odor which was perceptible."

Page 335, int. 21.

And again he says of defendants' oil: —

"It had very little odor, the least of any oil I had ever seen The character was that of all other oils of that kind, but almost imperceptible. I would not call it a distillate smell; it more resembled some animal oil, a fatty smell."

Page 339, ints. 55, 56.

As to the identity of the two oils for commercial purposes, Mr. Treat, an extensive oil dealer, testifies as follows: —

"*Int.* 17. Do you know of any other paraffine oil in the market at present, which fills substantially the same place in the market, and is capable of the same uses, so far as your trade is concerned, as Merrill's oil?

"*Ans* Several agents have presented me with samples of oils called Tweddle's Eclipse Oil, and Tweddle's Topaz Oil, and the Eclipse Oil manufactured in Pittsburg, Pennsylvania. Those oils even at the lowest price which is offered, of fifty cents and fifty-seven cents, resemble the Merrill oil in body, color, and odor. These come in competition with the Merrill oil, only from the price, the price being less.

"*Int.* 18. When you say they come in competition only from the price, do you mean to be understood that they are capable of the same uses, or not?

"*Ans.* I do. They are nearly the same article; as nearly perhaps as they could come without chemical analysis, and I don't know, even then"

"*Int.* 22. Besides Tweddle's oils of which you have spoken, do you know of any other oil in the market which fills the same place as Merrill's or not?

"*Ans.* I do not."

Page 46.

For use as a wool oil, a purpose for which we have already shown that the old oils were not adapted at all, Mr. Maguire testifies respecting Merrill's and Tweddle's oils as follows: —

"*Int.* 17. Since you have known and dealt in Merrill's oil, have you been acquainted with other oil in the market which in these respects was similar to Merrill's oil, and which you have used for the same purposes in your trade?

"*Ans.* I have known the Eclipse Topaz Oil as such.

"*Int.* 18. Do you know by whom and where the Eclipse Topaz Oil is made?

"*Ans.* Made in Pittsburg by Mr. Tweddle, as I am informed by the agent.

"*Int.* 19. State whether you have used the Topaz Oil in combination with fatty oils, to produce an oil for use upon wools.

"*Ans.* I have.

"*Int* 20. What was the result?

"*Ans.* It made an oil, to all appearance, practically as good as Merrill's.

"*Int.* 21. State if you know in what proportion it can be mixed with fatty oils, and produce an oil suitable for use upon wool.

"*Ans.* In any proportion from twenty-five to seventy-five per cent."

Page 42.

On this point also the defendant Yeomans says: —

"I use of Merrill's or Tweddle's, whichever I have in stock. In my judgment, they are of equal value for wool purposes."

Page 181, int. 22.

The foregoing evidence stands upon the record uncontradicted.

No attempt has been made to meet it, and the only thing in the record conflicting with it is the bare assertion of Tweddle, the manufacturer of the infringing oil and the real defendant in this suit, that his is a different oil from Merrill's; and even this assertion was made only on cross-examination, and is unsupported by any explanation or any attempt to point out the distinction between them.

This omission on the defendants' part is the more remarkable, as he has called for other purposes a large number of witnesses, whose qualifications as experts were undoubted, and whose business had given them ample opportunities of judging of the character of the respective oils. Prof. Horsford, an eminent chemist, Messrs. Thayer, Lincoln, Coffin, Yeomans, and Goss, all extensive manufacturers of paraffine oil, and a large number of dealers and consumers, have all testified, but not one has been asked whether he considered the two oils as substantially different, and not one has volunteered an opinion upon the subject. Several dealers, to be sure, have expressed a preference for one of the oils over the other on account of slight differences in odor and color; but here they stop, and fail entirely to show that the differences were sufficient in degree to constitute a substantial distinction between them. On the

contrary, the manner in which their testimony was given carries with it the inference that they treated them as substantially the same thing.

As to the Process of Manufacture.

If the appellant's patent be construed as he contends it should be, viz., for the described article of manufacture, however produced, it is immaterial whether the defendant's oil be made by the same process or not.

A comparison of the processes serves, however, to confirm the previous evidence derived from the examination of the articles themselves, by showing that their points of resemblance are not accidental, but result from the same causes in each case.

If, however, the construction placed upon the patent by the Court below be adopted, viz., that it is for a new article of manufacture when made, and only when made, by the method described, the substantial identity of the processes becomes an essential element in determining the identity of the articles themselves.

We have already pointed out that, prior to Merrill's invention, all the paraffine oils in the market were characterized by certain offensive odors, which were believed by all manufacturers to be inherent in the oils themselves, and that the only methods resorted to to diminish these odors were directed to the destruction of the odors themselves by the use of chemicals, and filtration through animal charcoal.

We have further shown that the gist of Merrill's invention lay in the discovery that these characteristic odors did not belong to the heavy oils themselves, but were due to the presence of light volatile oils, which could be removed from the heavy oil by a process of fractional distillation so conducted as to generate no new odors to

replace those thus removed. This discovery he carried into practical effect, and the result was his deodorized oil. In his patent he describes this and claims it as a new article of manufacture. He also describes the particular process which he prefers for producing this result, but he does not limit himself to the precise details of that process or the order in which they are there directed to be performed. Several modifications of the process are mentioned in the patent itself.

Under these circumstances he is entitled to consider any process as substantially the same as his own which eliminates the light volatile oils by fractional distillation in such a manner as to produce no new odorous bodies, leaving at the close of the operation a heavy, inodorous oil, substantially the same as that described in his patent.

The processes respectively adopted by the plaintiff and defendant may be briefly described as follows: —

The plaintiff takes heavy hydrocarbon oil, from which the lighter oils and the coke and tarry matter have been separated by distillation, chills and removes the solid paraffine, places the oil in a still, and by a slow and gradual application of heat distils off the light volatile oils until the residuum has reached the gravity of from 32° to 36° Baumé, when the operation is complete. This distillation may be conducted either by fire alone or by fire and steam, but the patentee recommends the latter. He shows also in his patent that it is not essential that the lighter burning oils and naphthas should be removed before commencing the above-described process, as they are readily removed by the application of heat, and their presence only prolongs the subsequent distillation.

Commencing, then, with the crude petroleum, the plaintiff's process, as first described, involves, first, the distillation of the naphthas and illuminating oil; secondly, the distillation of the heavy oil, separating it from the tarry matter and other mechanical impurities which are left behind in the still; thirdly, the removal of the paraffine; and, fourthly, the removal of the light odorous oils by distillation, leaving behind the deodorized oil.

The defendant takes crude petroleum and, by the aid of superheated steam and a vacuum, distils off first the naphtha and the illuminating oil, including such light, offensive oils as may have formed during the process, and continues this distillation until the gravity of the residuum has reached 28° to 35° Baumé. The distillation is then continued at a comparatively low heat to prevent the further decomposition of the oil, until all the heavy oil has passed over into the receiver. Finally, the paraffine is removed from this distillate in the usual manner, and the result is the defendant's "Neutral Topaz" oil.

A careful comparison of these two processes shows that the same steps are taken in each, and that the only difference is in the order in which they are taken.— Merrill vaporizing his heavy oil and separating it from the tarry residuum near the beginning of his process, while Tweddle does it near the close. Both processes have the same end in view, viz., the production of a neutral oil. Both depend upon a knowledge of the fact, first made known to the public in Merrill's patent, that the odor of paraffine oils was due to light volatile oils associated with them; both carry out this principle by a process of fractional distillation for the purpose of separating these oils; in both this process is so conducted that during or after the removal of the volatile oils no further formation of such oils takes place; and both produce, as the result of this process, oils having the same distinctive qualities.

Identity of the two Processes.

The substantial identity of these two processes is conclusively demonstrated by two series of experiments conducted by Professor Silliman, Dr. Hayes, and Mr. Merrill.

The first of these series consisted of four experiments, two of which were designed to meet the several conditions alluded to in

Merrill's patent, while the other two were performed with the aid of a vacuum, but differed only in this respect from the others. In each case the material operated upon was a heavy hydrocarbon oil, which had been once raised in vapor, and from which the tarry matter and coke had been separated by the previous distillation.

A comparison of the results of these experiments shows that the use of the vacuum produced no corresponding change in the products of the distillation, and leads directly to the conclusion that the use of a vacuum in the manufacture of the deodorized oils is, at the most, but a modification of Merrill's process, and not an entirely distinct means of attaining the same result.

These experiments and their results are thus described by Prof. Silliman : —

"The four experiments to which I allude were intended to demonstrate the results of the four following processes: first, Merrill's process, properly so called, employing fire and steam; second, a process by fire alone; thirdly, a process by fire, steam, and vacuum; and fourthly, a process by fire and vacuum without steam. Each of these processes was carried through upon one hundred and forty-eight gallons of the same raw material, and the details thereof and the results obtained I will state at length, if so desired. The raw material employed in each of the foregoing experiments was petroleum from which all the light oils, meaning naphthas, the illuminating oils, the tarry matters, and the paraffine had been removed in previous processes. In regard to the character of the products obtained in each of these experiments, it is sufficient to say that they were all in their essential characters substantially alike, and like to the product said by the patentee to be obtainable where the methods described in the patent are practised.

"*Int.* 13. Will you state how the products which were distilled over, as you approached the line of demarcation for this deodorized oil, corresponded?

"*Ans.* They were substantially alike."

Page 136.

The second series of experiments is still more significant in its results. In these the raw material employed was crude petroleum, and the distillations were conducted with the aid of fire and steam, and with fire, vacuum, and steam. In each case the tarry matter and paraffine were separated at the close of the experiment instead of at the beginning, as when heavy oils were taken as the basis. In all other respects than this the directions of Merrill's patent were, in the first experiment, strictly followed. It will be observed that,

while the first of this series of experiments differed from that specifically described in Merrill's patent only as respects the order of the steps, the last was precisely the same as that used by the defendants, the distillation being performed by *fire, steam and a vacuum.*

Tweddle, p. 169, ans. 114.

As to the effect of the variation in the order of the steps, Prof. Silliman says: —

"It is well to remark in this connection, that the experimenter may elect at what point in the progress of the distillations he will separate the paraffine produced in the previous stages of destructive distillation of the petroleum, and also when he will separate the tarry matter always inherent therein. In the last-mentioned experiment, I elected to make those separations in the manner already specified, and not in the manner described by Merrill in his patent. But I consider the departure from the specific directions of Merrill, in this experiment, as merely formal and not essential departures or variations."

Page 92.

Referring to the same experiment, Dr. Hayes also testifies as follows: —

"*Int.* 30. Will you state whether you found in this experiment that the presence of the paraffine tarry matters and separated carbon in the still interfered with the separation of the heavy hydrocarbon oils from the light and offensive bodies; and whether or not you obtained from the distillates going over before you reached the dividing point for the heavy oil, the same body as when you used the heavy hydrocarbon oil, spoken of in Merrill's patent as the material from which you obtained the deodorized oil?

"*Ans.* The presence of these substances did not interfere with the separation of light, odorous hydrocarbons. I did obtain in this distillation bodies like those obtained when making the deodorized oil from heavy hydrocarbons."

Page 77.

Both these witnesses testify that the products obtained by this process, as well as those obtained by distilling petroleum with fire, steam and a vacuum, as described by Tweddle in his patent, were substantially identical with Merrill's deodorized oil.

Silliman, p. 91, int. 14; p. 92, int. 15.
Hayes, p. 77, ints. 30, 31.

And not only were the finished oils produced by these experiments identical, but the products at corresponding stages of the different experiments were also substantially the same.

Prof. Silliman testifies as follows on this point: —

"*Int.* 18. Did you in those experiments compare the products which you obtained as the distillations approached the dividing line which you adopted between the light and heavy oils, with each other, and with those which you obtained at the same stage of the distillation, when following the directions of Merrill's patent?

"*Ans.* Samples of every fraction of five gallons from the commencement to the end of each of the several experiments were saved and preserved for study and comparison; and I found no substantial difference between them, when comparing those of corresponding densities."

Page 93.

Hayes says: —

"They were identical in odor and density, the characteristics of the most importance."

Page 78, int. 33.

See also Exhibit 137, p. 537, explained p. 528.

These products, as the Court will perceive from an examination of samples produced as exhibits, are characterized by offensive odors, the result of the previous distillation of the oil, and evidently contain, to a greater or less extent, those volatile offensive oils which it was the object of Merrill's invention to remove and prevent.

See Exhibits 18, 19, 20.

This clearly shows that the same steps must have been taken in each case at some stage of the respective processes, and that the apparent difference between the two processes arises only from the fact that the steps are taken in a different order in one case from that adopted in the other.

Both of these witnesses testify, as the result of these carefully conducted experiments, that, in their opinion, the processes by which the plaintiff's and the defendants' oil were respectively made are substantially the same.

Silliman, p. 93, int. 19.

Hayes, p. 78, int. 36.

And there is no testimony, except Tweddle's bare assertion to the contrary, to contradict them.

It is testified by Dr. Tweddle, the real defendant, that as matter of fact no such offensive oils are formed in the previous stages of the production of his oil as are formed in Merrill's process, and he claims that where a vacuum is employed no such odor can be produced.

As to what takes place in the practical manufacture of the oil at Dr. Tweddle's works, we have only the evidence of the doctor himself, and one of his workmen, whose testimony we shall show hereafter is entirely unreliable.

It is in evidence that, prior to the commencement of this suit, Mr. Downer, on behalf of the plaintiff, proposed to Dr. Tweddle to allow each to examine the other's process of manufacture, with the view of ascertaining amicably whether either was infringing on the other's patents.

Downer, p. 404.

This proposal was declined, Dr. Tweddle refusing to allow any inspection of his works.

Dr. Tweddle has testified as to his process of manufacture, but no disinterested witness has been called to support his testimony, nor has any such witness testified that the experiments of the complainant's experts were inaccurately performed, or that incorrect conclusions were drawn from them. So far as the questions now under consideration are concerned, the defendants have rested their whole case on the testimony of Dr Tweddle.

We shall show hereafter not only that his direct pecuniary interest in the result of the case was such as to make him a biased and prejudiced witness as to all matters of opinion and judgment, but that his statements as to matters of fact have been, if not wilfully false, so contradictory and inaccurate that no reliance is to be placed upon them.

That these offensive oils are, as matter of fact, produced in the prior stages of distillation, whether a vacuum be employed or not, is not only shown by the experiments above referred to, but from other collateral evidence.

It is admitted by both parties that such offensive oils are the result of a destructive distillation of the crude oil.

Now, Dr. Hayes testifies, as a matter of practical observation and experience, that such destructive distillation takes place even in the removal of the naphthas, at the commencement of the process, and continues during the distillation of the illuminating oil.

Record, p. 83; cross-ans. 35, 37, 38.

A further proof is found in the fact that all illuminating oils are characterized by certain peculiar offensive odors, different from the odor of crude petroleum, and doubtless formed in the process of distillation.

That such destructive distillation is not necessarily avoided by the use of a vacuum is further shown by the fact, which we shall prove conclusively at a later stage in the brief, that Dr. Tweddle for years distilled oils with the aid of a vacuum in such a manner as must of necessity have produced a complete destruction and breaking up of the crude oils and have been accompanied by the formation of light, odorous bodies.

Even were it shown that by the use of a vacuum the production of odorous volatile oils in the earlier stages of the distillation was diminished, the process would still be substantially the same as Merrill's, inasmuch as it proceeds on the same principle, — that the offensive odors are due to the light oils, which must be removed, if formed, and their further formation prevented, as Merrill has directed in his patent, "by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil."

This principle is directly recognized by Tweddle in his patent of 1870 (record, p. 496), where after describing the previous stages of

the distillation, he says, "The distillation is then continued *with a comparatively low heat, so that the heavier ingredients of the oil shall not be decomposed.*"

All that Tweddle can with truth be said to have discovered was that by carefully conducting the process of distillation he could, after distilling off the light, odorous oils with the illuminating oil, distil over the heavy oils at a temperature which would not form new offensive bodies, thus enabling him to remove the tarry matters and develop the paraffine at the close of the process instead of at the beginning, — a change which, as we have shown, is merely formal.

Dr. Tweddle has objected to the conclusiveness of the experiments of Prof. Silliman and Dr. Hayes, on the ground that while professedly following his process they conducted the distillation by fire, vacuum and superheated steam instead of by vacuum and steam without fire as he alleges he does.

He has, however, entirely precluded himself from claiming that this difference is an essential one.

In 1870 he took out a patent for a process of which he claimed that his Neutral Topaz Oil was the specific product, and which consisted in a careful distillation of the oil *in vacuo*, concluding with the use of a low temperature to prevent the decomposition of the oil.

In the specification of this patent he says, "In this process I distil with a comparatively low heat produced by free steam, superheated or not at pleasure, in a vacuum or partial vacuum *with or without a fire on the outside of the still.*"

Record, p. 495.

He has also testified that for a long time prior to taking out this patent he had used steam and a vacuum alone, as well as with fire heat. If therefore the use of fire made any substantial difference in the operation he must have known it when he took out his patent, and was not only bound to point out such difference in the patent itself but would naturally have done so had such been the fact.

Instead of so doing, he says in substance that fire may or may not be used at pleasure.

Finally, he testifies explicitly that in the practical manufacture of his Neutral Topaz Oil he uses "a vacuum still, heated by superheated steam, *with or without auxiliary fire.*"

Tweddle, p. 169, ans. 114.

Dr. Tweddle has further objected that the vacuum used by the plaintiff's experts was much less perfect than that which he uses in practice, their's being from eighteen to twenty-two inches while he claims to have used a vacuum of from twenty-eight to thirty-one inches.

Record, p. 201, cross-ans. 84.

That this last mentioned degree is impossible to obtain is evident from the well-known scientific fact that a perfect vacuum is only thirty inches, and sometimes less, dependent on the height of the place of observation.

Hayes, p. 533, ans. 39.

Dr. Hayes testifies that in practice it is nearly impossible to produce as perfect a vacuum as Dr. Tweddle says he employs, and he speaks from an extensive practical acquaintance with processes of vacuum distillation where the importance of producing a perfect vacuum is as great as in distilling petroleum.

Moreover, in his patent above referred to, Dr. Tweddle states that his process may be carried on with a vacuum or *partial vacuum.*

Record, p. 495.

The complainant's experts were men of great scientific skill and acquirements; they had Dr. Tweddle's patent before them, and were endeavoring to follow its directions, knowing at the same time that on the accuracy with which they did so depended entirely the value of the results.

When, therefore, they employed the degree of vacuum which they did, it is only a fair presumption that this was what any skilled chemist would adopt in endeavoring to carry out Dr. Tweddle's pro-

cess, and it was incumbent on the defendants, if they meant to dispute the accuracy of the experiments, to show by positive proof that such a vacuum would not produce the results which Dr. Tweddle produces with the vacuum which he employs.

The statement by which Tweddle endeavors to support his opinion that his oil is not substantially the same as Merrill's, viz., that his oil is a distillate, while Merrill's is a residuum, is plainly erroneous, as Merrill has shown in his testimony.

"*Int.* 29. Dr. Tweddle, in his answer to the 148th direct interrogatory, after describing briefly the process described in your patent for producing deodorized oil, says, 'The residuum in the still after this process is Joshua Merrill's oil, and is a residuum'; and in answer to direct interrogatory 153, after briefly describing the method in which he produces neutral topaz oil, he says, 'My neutral topaz oil is a distillate.' Will you state whether or not it is true that, while his oil is a distillate, your oil is a residuum, and not a distillate?

"*Ans.* My oil in all cases is a distillate; and in order to produce my oil the petroleum from which it is derived must be distilled over, in order to separate from it the tarry and coky matters which are developed in the process of distillation, and in order to develop the paraffine in a crystallized form, so that it may be possible to separate it from the oil. There is no known way of separating paraffine from petroleum excepting by the process of distillation, which develops or produces the paraffine in such a form that it may be separated. The oil made by Dr. Tweddle is also a distillate, and cannot be made by any other process than distillation.

"*Int.* 30. In what sense, if any, is your oil a residuum?

"*Ans.* My practice is to place the distillate, after the paraffine has been removed from it, in a distilling vessel, and at as low temperatures as possible to distil off any light, thin, offensive oils that may be associated with it. The oil, after this operation is completed, remains in the distilling vessel until cooled sufficiently to make it convenient to pump it out into receptacles for holding it. In this sense, it is a residuum.

"*Int.* 31. Referring then to crude petroleum, your oil, then, as I understand it, equally with Dr. Tweddle's, is a distillate and not a residuum, and has had the tarry and coky matter removed from it, and the paraffine developed by distillation just as Dr. Tweddle's neutral topaz oil.

"*Ans.* It is, as you understand it, a distillate, and both oils are treated precisely in the same manner and for the same purpose."

The identity of the two processes appears also from the statements of Tweddle in his patent of 1870.

He there describes and claims as a new article of manufacture the Neutral Topaz Oil, which we claim to be an infringement of the plaintiff's patent. He points out as its distinguishing characteristics the superiority in body; the slight odor, almost entirely removable by slight chemical process; and the almost entire absence of the blue or green tint termed in the record "fluoresence." He then says: —

"The lubricating oil thus described is a specific product of this mode or process of manufacture, and cannot be made in any other way. By the qualities specified it is readily distinguishable, by any one skilled in the art, from all other lubricating oils heretofore known to the trade."

Page 448.

Now, admitting this oil to be readily distinguishable from most of the lubricating oils then known in the market, we have shown that a considerable number of those "skilled in the art" do not distinguish it from the *plaintiff's* oil, and that in fact it is substantially the same thing. If therefore this oil is a specific product of the process described in the patent, and can be made in no other way, and is the same as Merrill's oil, Merrill's oil also must be produced by the same process. And this we have no doubt is the fact. The whole of the expert testimony as to the manufacture of this and other paraffine oils tends to show that Merrill's oil is also a specific product of his process, and the proven identity of the two oils proves also the substantial identity of the processes.

ALLEGED PRIOR INVENTION BY DR. HERBERT W. C. TWEDDLE.

The amendment to the answer, filed Nov. 13, 1871, on p. 4, taken in connection with the second clause of the original answer, filed May 24, 1870, and the first amendment on p. 5, filed Oct. 3, 1870, alleges that the said improved manufacture of deodorized hydrocarbon oils described in said Letters Patent was described and patented in —

"Letters Patent of the United States granted to H. W. C. Tweddle, Feb. 4, 1862, No. 34,324, and the reissue thereof of No. 2,404, granted Nov. 27, 1866, and also that the said improved manufacture of deodorized heavy hydrocarbon oils, described in the complainant's patent, or a substantial and material part thereof, claimed in said patent as new, was, before the alleged invention thereof by the complainant, known to and used by the said Tweddle, who is of Pittsburg, in the State of Pennsylvania, at Sharpsburg bridge, near said Pittsburg"

The amendment containing this allegation, also contains the statement, —

"That the said neutral topaz oil is, as they are informed and believe, manufactured by the said Tweddle, according to a process invented by himself long before the alleged invention of the complainant, and fully described and patented in his said patent of Feb. 4, 1862, reissued Nov. 27, 1866, and in Letters Patent granted to him Dec. 10, 1867, and numbered 72,126."

Before considering the evidence in support of these allegations, it is important to consider Dr. Tweddle's relation to this case.

It appears by the original answer, clause 3, and p. 3, andthe last amendment, p. 5, that Dr. Tweddle is the manufacturer of the oil for the sale of which the defendants are complained of.

Dr. Tweddle has been examined as a witness, and on cross-examination testified as follows (p. 193) : —

"*Cross-Int.* 1. You have a pecuniary interest in the result of this suit, have you not?

"*Ans.* Yes.

"*Cross-Int.* 2. State what that interest is.

"*Ans.* I am the manufacturer of the neutral topaz oil in question.

"*Cross-Int.* 3. Have you not assumed the management of the suit and retained and paid counsel who are employed in it, or agreed to do so?

"*Ans.* I don't know whether that is a right question to answer.

[*Counsel for the defendants inform the witness that in their judgment this is a proper question, whereupon the witness proceeds to answer.*]

"*Ans.* I have.

"*Cross-Int.* 4. Have you not agreed to indemnify the defendants in this suit and save them harmless from any judgment that may be obtained against them?

"*Ans.* Really, I don't know, as a matter of law.

"*Cross-Int.* 5. Have you made any agreement with them in respect to this matter?"

"*Ans.* I once met one of the partners in the concern, — namely, Yeomans and Goss, — which of them I really forget."

[*At this point, the counsel for the defendants inform the witness that having admitted*

that he has a large pecuniary interest in this case, the question which is now put is in their judgment improper, and he is under no obligation to answer.]

[*The witness thereupon refuses to proceed further in reply to the last cross-interrogatory.*]

"*Cross-Int.* 6. Have you, from the commencement of the suit, conferred, from time to time, with the counsel of the defendants in regard to the defence, and the manner in which it should be conducted?

"*Ans.* I have."

On p. 224 he testifies as follows: —

"*Cross-Int.* 319. Will you look at the three notices contained on the slip marked "Exhibit No. 83," and state whether or not they were published in the Boston papers in the spring of 1870, by your direction or with your sanction?

"*Ans.* The notices in question I never saw before I saw them published in the Boston papers. I told Mr. Bartlett, my agent, that if the Downer Kerosene Co. did not stop threatening and intimidating my customers, to take some steps by publishing a protest against the manner in which they were acting. He, I presume, wrote these notices and caused them to be published."

The notices referred to are as follows: —

"EXHIBIT NO. 83.

"'*Eclipse*' *Neutral Topaz Oil. Notice from the* '*Eclipse*' *Petroleum Refinery, Pittsburgh.*

"In regard to any suits brought against consumers or dealers in my neutral topaz oil, for infringement of any Letters Patent of Joshua Merrill, or the Downers Kerosene Oil Company. I undertake to defend such suits, and to guarantee the defendants against any costs or damages recovered against them in such suits, provided they place their defence in the hands of my counsel, Messrs. Bakewell & Christy, of Pittsburg, or Causten Browne, Esq., of Boston, and notify me thereof.

"HERBERT W. C. TWEDDLE.

"J. R. BARTLETT, General Agent, 127 State Street, Boston."

"*To dealers and consumers of* '*Eclipse*' *Neutral Topaz Oil, and to all others whom it may concern.*

"It having come to my notice that for some time past the Downer Kerosene Oil Co. have repeatedly made threats of intimidation against my customers, viz.: That they would institute suits against them for the supposed infringement of some of their patents in the purchase and use of my oils — this is to notify all parties who may buy, sell, or use my products, that I will protect them in the free use of the same.

"*These oils are manufactured under patents granted to me, and in no wise infringe the rights of any one.*

"They prove superior in every respect to the Downer Co.'s oil, or any other product of petroleum, which is doubtless the reason of the threats of intimidation so freely uttered of late by the aforesaid Downer Kerosene Oil Co.

"H. W. C. TWEDDLE,
"Eclipse" Petroleum Refinery, Pittsburg, Pa.
"J. R. BARTLETT,
127 State Street, General Agent for the "Eclipse" Works of Penn'a."

And on p. 233, on redirect examination, he testifies in respect to these notices as follows: —

"*Int* 218. Certain newspaper notices, Exhibit No 83, have been shown to you, and you say that you never saw them till you saw them published in the Boston papers: had you given any directions as to notices of that general character, and do you now mean to be understood as disclaiming anything contained in those notices?

"*Ans.* I do not disclaim anything contained in those notices, but fully sanction them, and gave instructions, I believe, to Mr. Bartlett or Mr. Causten Browne to have them published."

Thus it appears that this alleged prior inventor is the real defendant in the case, and has been from the outset; and that he must have known as well when the original answer was filed, and the first amendment, as at any time afterwards, what his patent of 1862, and its reissue, and his patent of 1867 embraced, and what he had done under them.

And yet, knowing all this when the first answer is filed, if he ever knew it, he does not set himself up as a prior inventor, does not allege that he is making the oil according to a patent granted to him seven years before the date of the plaintiff's patent, and according to another one granted to him a year and a half before, but allows the defence of prior invention to rest upon the allegation that the invention was known and used by one George M. Gallop of Salem, Eben Seccomb of Boston, and Edward S. Thayer of Salem. As to two of these men, Gallop and Seccomb, no evidence whatever has been offered, unless they were members of a firm with Mr. Thayer, which does not appear; and as to Mr. Thayer, though he has been examined as a witness, there is not, as we have seen, the slightest reason to believe that he ever, either before or after Merrill's invention, made a gallon of oil like either Merrill's or Tweddle's.

Not satisfied with the answer as first filed, his counsel a few months later filed an amendment setting up that the invention was described and patented in three English patents of 1854, 1855 and 1856. But these patents have not been produced in evidence, and no attempt has been made to prove that they embraced the invention.

If Dr. Tweddle had really made, practised and patented the invention years before Merrill did, as he now claims, can it be believed that he would have failed to communicate the fact to his counsel, and that, if he had done so, they would have failed to make it a part of the original answer?

When searching the English patents for proof of the prior existence of the invention, could he have failed to remember that it was embraced in more than one of his own prior patents, — patents, too, which were then and are now in force, and under which, if the allegations of his last amendment be true, he might not only successfully defend this suit, but claim the invention to be his own property? If a man fails to set up a title in himself when his right is challenged, the conclusion is a fair one that he has no title. Especially is this true when under the adverse title he may become liable to heavy claims for damages.

It was not till after the plaintiff had proved his *prima facie* case, and it had become apparent that the defence of prior invention as it then stood upon the answers would fail completely, that Dr. Tweddle came forward as a witness, to prove, without prior notice to the plaintiff of his purpose, that he was himself the first inventor.

We therefore claim, not only that he is a witness so largely interested in the result of the suit that his testimony should be received with caution and be closely scrutinized, but that the circumstances under which this defence was set up are such as to raise a strong presumption against it, — a presumption which can be overcome only by the clearest and most satisfactory proofs.

But it is not alone in the manner in which this defence is set up in the case that the inconsistency between Dr. Tweddle's claim to be first inventor of this invention and his acts or conduct is seen. His answer, as finally amended after his testimony had been given,

claims that the invention was described and patented in a patent granted to him Feb. 4, 1862, and reissued Nov. 27, 1866; and that his Neutral Topaz Oil was manufactured according to a process invented by him, and fully described and patented in the said patent of 1862 and its reissue, and in another patent of Dec. 10, 1867, And yet, in January, 1870, about two months before the bill was filed, he applied for and obtained a patent dated Feb. 15, 1870, in which he claimed the production of his Neutral Topaz Oil in these words: —

"The production by the process hereinbefore described of a lubricating oil as a new article of manufacture, possessing the distinctive and distinguishing features above set forth, viz, almost entire freedom from the blue and green tints which characterize the paraffine oils of commerce."

In the specification, he commences by saying that he has "invented a new and useful improvement in the *manufacture* of paraffine and *paraffine oils*," and he also says that his "invention relates to the distillation of petroleum and other hydrocarbon oils which can be made to yield a considerable percentage of paraffine, and *consists in* so carrying on the *process of distillation*, that little or none of the paraffine will be decomposed," etc. Having described the process, he describes the oil as follows: —

"The oils which in the process described are expressed from the paraffine product, are for lubricating purposes, vastly superior to the lubricating oils produced by the distillation of the tarry residuum of the old process, or if made direct from petroleum by direct fire. Though of less gravity, averaging 30° to 35° Baumé, they have a much better body. They have but a slight pungent odor, which is easily and almost wholly removed by a slight subsequent chemical treatment, and have hardly a trace of the green or blue tint, which is a distinctive characteristic and an objectional feature of lubricating oils made by the ordinary process. The almost entire absence of the blue and yellow tints and offensive odor renders this oil, which I have introduce in commerced as neutral topaz oil, much more valuable than the lubricating oils produced by distilling tar or petroleum or other hydrocarbon by the first process hereinbefore described and in general use."

In his patent of 1870, then, he says that he has *invented an improvement in the manufacture* of paraffine oils, that it *relates* to the *distillation* of petroleum, and *consists in carrying on the process* in a certain way; and he describes the oil as a specific product of the *mode* or *process* described which cannot be made in any other way; and he

claims the *production* by the *process described* of the Neutral Topaz Oil produced, as a new article of manufacture, while in the answer it is claimed that the same Neutral Topaz Oil is made by a process fully described and *patented* in patents taken out by him years before.

Thus, in making this defence, he is obliged to say, and does say, that the results described in his patent of 1870 as new and as being the specific product of the process described therein, and such as can be produced in no other way, are in fact produced in the process described in his prior patents, where no reference whatever is made to the peculiar features of the process described in the later patent.

If the law raises a presumption in support of the invention described in a patent, that presumption must be as strong at least against the inventor as against other parties, and he cannot allege in defence of a suit for selling the product which is the subject of his patent that this product, which he claims in his patent to be a specific product of the process described, is in fact the product of processes described in older patents to him, without raising a presumption against himself which he must overcome by the clearest proof.

Before examining closely the evidence relating to the alleged prior invention by Dr. Tweddle, it may be well to state generally the history of Merrill's invention, and what Dr. Tweddle claims to have done to anticipate Merrill.

The history of Mr. Merrill's invention is briefly this: On the 29th November, 1867, an accident to one of his stills made it necessary to suspend the distillation of the charge in it before the oil was all distilled over. Upon examining the oil remaining in the still, he found it to be unlike any oil he ever before saw.

During the month of December he made many experiments with laboratory apparatus, and during January with a fifty-gallon still, to

ascertain just what was required to produce this oil. He then commenced the distillation of the oil in a two-hundred gallon still, and when a sufficient quantity had accumulated, offered it to the trade as an article of commerce.

Merrill, p. 51, int. 12.

The sales commenced as early as March, 1868, certainly.

Smith, p. 14, int. 18.

During that year the sales amounted to 276,222 gallons. The next year they reached 465,290 gallons.

Merrill, p. 50, int. 8.

In the summer of 1868 Mr. Merrill went to Europe, carrying samples of his new oil, and visited various manufacturers and oil dealers, showing them his new product, and the result was that an export trade at once sprung up, and during the years 1868 and 1869 the Downer Oil Company sold 207,890 gallons to go to Europe.

Merrill, pp. 50, 51, ints. 8 to 11.

There has been no attempt to dispute these facts.

We thus see that Merrill was an original and true inventor; that he promptly placed the oil upon the market, both in this country and Europe; and that in due time he applied for and obtained a patent.

Although we have previously set forth the nature of Merrill's invention, yet we here repeat briefly the character of the oil he produced, in order to bring distinctly to mind what must be proved in order to anticipate the invention.

In his patent Merrill says (p. 7) that his oil is —

"free from the characteristic offensive odor of hydrocarbon oils, and has no smell, except a slight odor similar to that of fatty oils.

"It can be mixed in all proportions, with sperm, lard, fish-oils, and vegetable oils, and is so neutral in its character that it takes the odor of the oil that it is mixed with. If mixed with twenty per cent of sperm oil, it does not perceptibly change the smell of the sperm oil."

After describing the manner of making it, he says again (p. 10) : —

"It has been so completely divested of its fetid and pungent odors, having only a slight smell like a fatty oil, and has become so oily as to be greatly improved and increased in value as a lubricating oil, or for any purposes it may be used, either alone or mixed with other oils."

Again in the claim he describes his oil as —

"suitable for lubricating or other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil."

The evidence in the case fully proves that the oil made when following the directions of the patent, in addition to the above characteristics, is nearly free from certain green and blue tints which pertained to most hydrocarbon oils; and has a boiling point of 600°, which is one or two hundred degrees higher than the boiling point of the common heavy hydrocarbon oils, and is free from light hydrocarbons.

The oil is also described as being much more oily than the common heavy oils, and as having a better body, though of lighter gravity, and as being free from chemicals.

Tweddle, in his patent of Feb. 15, 1870 (Record, p. 494), describes his Neutral Topaz Oil as being, for lubricating purposes, vastly superior to the common lubricating oils, that is, more oily; as having a much better body, though it is of much less gravity; and as having but a slight pungent odor, easily and almost wholly removed by a slight chemical treatment, and hardly a trace of the blue or green tint.

The evidence shows that the Neutral Topaz Oil, by the sale of which it is claimed that the defendant has infringed the patent, not only possesses these characteristics, but that it has a high boiling point of 585°, is free from chemicals and light hydrocarbons, and has the same mixing qualtities as the Merrill oil.

The defendant Yeomans has admitted the substantial identity

of the two oils, and his belief that the Neutral Topaz Oil was an infringement of the patent.

Such being the proof of the characteristics of the patented oil and the Neutral Topaz, the proof of prior invention by Tweddle must show that he made an oil having these properties. It must be proved that he made an oil not only free from odor and the green and blue tinge, but that it was free from light hydrocarbons, and had the same high boiling point and body substantially, and substantially the same lubricating and mixing qualities.

Obviously the mere proof that oil which he claims to have made prior to Merrill's invention was free from odor and the green and blue tints, will not prove such oil was, like the Neutral Topaz sold by the defendant, free from the light hydrocarbons; for he testifies that the light or burning oils made by him at the same time, and by the same process, and from the same crude oil, were free from odor and the blue and green tints (p. 164, int. 79). And if so, then obviously they might be present in the heavy oils without imparting the odor or color which they did not themselves possess.

The importance of this freedom from light oils of the high boiling point, and the superior lubricating qualities of his Neutral Topaz Oil, are emphatically set forth by Tweddle in his circular on p. 450.

ECLIPSE NEUTRAL TOPAZ OIL FOR COMPOUNDERS.

"In offering this well-known brand to compounders of machinery oils, we beg to call their attention to the fact that it is the *only* hydrocarbon compounding oil in the market which, according to its boiling point of 650° Fahrenheit, does not evaporate any combustible gases or vapors at high temperature. The extreme cold at which the oil is manufactured, being 5° below zero in winter, renders the same *superior to any compounder known at present.*

"The 'Eclipse Neutral Topaz Oil' assumes, compounded with any kind of animal and some vegetable oils, the characteristic properties of the oil it has been compounded with, making the combination uniform in every respect.

"As the oil, as well as all our products, is manufactured *in vacuo* with superheated steam, we claim it is the only hydrocarbon oil which is free from blue or greenish tinge, caused by the polarization of reflected light.

"It is a well-known fact that animal and vegetable oils contain a certain percentage of glutinous or mucilaginous matter. To prevent those lubricants from gumming, paraffine oils have been formerly used to cut the oils and keep the gumming substances in solution. We admit that paraffine oils answer the purpose in some

respect; but if the combinations are used in hot weather, or in factories where high temperatures prevail, the low evaporating test of paraffine oils leads to many inconveniences, viz., offensive hydrocarbon smell, filling the atmosphere in workshops with combustible gases and vapors, and condensing oily matter on the window-panes, frequently affecting the eyes of the operatives.

"All these named disadvantages render paraffine oils unsuitable for a great many practical purposes, especially as compounded wool oils and spindle oils."

We turn now to what Dr. Tweddle claims in his testimony to have done to entitle him to be treated as the prior inventor.

Experiments at Standard Works.

First. He testifies that repeatedly during the years 1864, 1865 and 1866, while at the Standard Works in Collins township, he produced in an experimental apparatus heavy paraffine oil, with, as he says, "very little odor compared with that from fire distillation, and almost devoid of the blue color or fluoresence."

Page 162, ints. 62, 63, 64; and p. 191, ints. 183, 184.

On p. 163, in answer to int. 68, he says this oil "was yellow, something like olive oil; the density between 33° and 35° Baumé, with very little odor. It was light. It was *something like what I now call the Neutral Topaz Oil, which I manufacture.*"

He does not here claim that this oil, produced *in an experimental apparatus*, was substantially the same with either the patented oil or his Neutral Topaz Oil, or that it was produced by the same process. In addition to this, we do not understand that the allegation in the amended answer, of prior invention, was intended to embrace these experiments at the Standard Oil Works, which were in Collins township. The allegation is that the patented invention "was before the alleged invention thereof known and used by the said Tweddle, who is of Pittsburg, in the State of Pennsylvania, at *Sharpsburg Bridge, near said Pittsburg.*"

For Dr. Tweddle, when asked in respect to what he did at the Standard Works, what results he obtained (p. 162, int. 63), states that he "obtained results which in a measure induced me to build the Eclipse Petroleum Refinery at the Sharpsburg Bridge, Alleghany County." He appears to make a clear distinction between the two places. We are justified in assuming that neither in the testimony nor the answer is it claimed that the results obtained by him at the Standard works with the experimental apparatus anticipated Merrill's invention.

At all events, his testimony wholly fails to prove that they did. The most it shows is that he made *experiments*, and obtained, as a result, oils *something like* his Neutral Topaz Oil. It may be added that no other witness makes any reference to this use of an experimental apparatus or to the results claimed; and when we add that Neutral Topaz Oil is worth about twice as much per gallon as illuminating oil, or any other lubricating oil produced by him from petroleum, we may safely conclude that if he *could* have made Neutral Topaz Oil, he *would* have made it and sold it; and that as he *did* not make it for sale, it was because he *could not* then do it.

Barren County Oil.

Second. Notwithstanding the answer, as we have stated, apparently does not set up any claim to a prior knowledge of the invention at any other place than *Sharpsburg Bridge*, yet Dr. Tweddle does state that on one occasion, while at the Standard Works, he produced an oil like Merrill's by a process like that described in Merrill's patent, from two or three hundred barrels of petroleum, of a peculiar character, produced in Barren County, Kentucky.

Without waiving the objection that what he did at the Standard Works is not within the scope of the allegation of prior knowledge in the answer, as amended, we proceed to examine his testimony on this point and that of one witness called to support him.

Dr. Tweddle's first statement in respect to this Barren County oil is as follows (p. 163) : —

"*Int.* 70. State whether at any time previous to your leaving the Standard works you produced any oil as a residuum, having the characteristics of the heavy paraffine distillate referred to in your 68th answer.

"*Ans.* Yes; I did produce an oil as a residuum almost inodorous. It was a residuum of a second distillation by superheated steam, in a still heated by fire.

"*Int.* 71. State what kind of oil you produced this residuum from, and the process of distillation, together with the results of the process.

"*Ans.* I purchased in the fall of 1864 some two or three hundred barrels of petroleum which had a stinking and offensive odor. It was crude petroleum, and came, I believe, from Barren County, Kentucky, somewhere near the Tennessee line. I think that was the name of the county. No refiners here would purchase it, on account of its bad odor. I purchased it at a cheap price. In the spring of 1865 I treated this oil in an agitator with sulphuric acid, precipitating a heavy deposit of carbonaceous matter. I then treated the oil with alkali, etc., and distilled the oil by fire and super-steam. (The crude oil was of a very heavy gravity.) The distillate had a very bad odor. I treated it again in an agitator with sulphuric acid and alkali. I redistilled the oil again by fire and superheated steam. When the oil began to run from the condenser very yellow, I stopped the distillation. The residuum in the still was amber-colored, with very little odor. The distillate had a bad odor, which was only partially removed by another treatment with acid and alkali. This residuum was substantially the same as the oil produced by the process of J. Merrill, described in Letters Patent, No. 90,284, and the process was substantially the same."

Beyond the statement that the residuum was amber-colored, with very little odor, and that it was substantially the same as the oil produced by the process described in Merrill's patent, and that the process was the same, there is no description of the character of this oil. The witness tells us nothing about its specific gravity, or boiling point, or its body, or its lubricating qualities, or its action when mixed with other oils.

At a later stage of his deposition (p. 191, ints. 189, 190), the subject was again adverted to, as follows : —

"*Int* 189. You have spoken of some petroleum you bought in the fall of 1864, that came, you believe, from Barren County, Kentucky and that you treated this oil in an agitator with sulphuric acid, precipitating a heavy deposit of carbonaceous matter: before so treating the oil, did you vaporize it, or attempt to do so?

"*Ans.* I made several small experiments to test the qualities of the oil, and considered the treatment which I described in answer to int. 71, as the sim-

plest and best applicable. I did not vaporize it at first, but treated it with sulphuric acid, etc , as it came from the wells. I then distilled it, and re-treated the distillate, which had a bad odor. I redistilled again, and treated the distillate again with acid and alkali.

"*Int* 190. You speak of the residuum obtained from this oil as being substantially the same as that produced by the process of Mr. Merrill, described in his patent No. 90,284. State why you tried the experiment, whether you sold the oil so produced, and if not, why not.

"*Ans.* I purchased all kinds of oils from new oil districts, for the purpose of testing them. I did not sell the resi tual oil, — I was not in the lubricating business, — but decomposed it into burning oil."

These questions and answers clearly imply that the distillation was a mere experiment, and that nothing came of it. This is more clearly manifest from his answers on cross-examination on pp. 223, 224, where he repeatedly says that he has forgotten almost every particular inquired about as to the treatment and results, and where, in answer to cross-int. 318, he speaks as follows: —

"*Cross-Int.* 318. Can you give the percentages compared with the crude petroleum of the distillate and residuum of the second distillation?

"*Ans.* I cannot. All I remember is this, — that when I found the still running yellow and spoiling the distillate already made, I told the distiller, or the foreman, to have the operation stopped. They showed me a sample of the residuum in the still. I found that the crude oil would give a very great deal of trouble and expense in the works to use it, and I abandoned it as not being useful for our purposes, and thought no more about the matter. The residuum in the still was yellow after the second distillation and had very little odor."

Clearly this was merely an experiment, which was abandoned at the outset.

Dr. Tweddle was again called as a witness, and again examined as to this oil, and his testimony then was so remarkably at variance, on one point, with his statement in the above answer, viz., "*I found that the crude oil would give a very great deal of trouble and expense in the works to use it, and I abandoned it as not being useful for our purposes, and thought no more about the matter*," that we reproduce it as showing that his statements in relation to this matter are entitled to no confidence.

"*Int.* 69. Speaking upon the same subject, Mr. Merrill says that taking, say, one hundred and eighty-one barrels, being the distillate which was pumped into the

still for redistillation, it could not have been distilled down into a residuum of only about five per cent without having a considerable percentage of heavy oil mixed with the lighter burning oil and leaving in the still a tarry and black residuum. Will you examine this part of his testimony also, being on p. 646, and say how far he is in error here, if at all, and why?

"*Ans.* Mr. Merrill is entirely incorrect. The oil was of a different character and made under entirely different conditions than those in which ordinary petroleums are manufactured. I do not think that there was much heavy oil run over in the first distillation; in the second distillation, I don't think there was any run over. The illuminating oil obtained had a singularly low fire test, but I was so much pleased with the results obtained that we despatched a gentleman down to Kentucky and Tennessee to try and obtain a large quantity of it. It was almost worthless there, but the difficulty of building boats and running it down either the Tennessee or Cumberland River prevented our getting any of it. I have lately purchased a large amount of similar oil from Terre Haute, Ind., and will be enabled to prove the accuracy of my statements as to the separation of the acid and alkali."

Page 476.

Could any two statements be more distinctly contradictory?

According to one statement he found that *the crude oil would give so much trouble and expense that he abandoned it as not being useful for his purposes, and thought no more about it.* According to the other, *he* was *so much pleased* with the result that, instead of abandoning it and thinking no more about it, he took the trouble and incurred the expense of sending a man to Kentucky and Tennessee *to try to get more of it.*

But the contradiction between his later and his earlier testimony extends still further. In his first statement on p. 163, speaking of the second distillation of this oil, he says, as to the burning oil, —

"I redistilled the oil again by fire and superheated steam. When the oil begun to run from the condenser very yellow, I stopped the distillation. The residuum in the still was amber-colored, with very little odor. *The distillate had a bad odor,* which was only partially removed by another treatment with acid and alkali."

If the burning oil produced by this second distillation, after all the acid and alkali treatment he describes, had a *bad odor* which was only partially removed by another treatment with acid and alkali, we may well believe his statement on p. 224, just quoted, that he found the crude oil would give a very great deal of trouble and expense in the works to use it, and he *abandoned it* as not being useful

for his purposes; thought no more about it. It seems not unnatural that he should abandon an oil that gave him all the trouble he describes, and yet yielded, as the chief result, a distillate with a bad odor which could be only partially removed by still another treatment with acid and alkalis. And yet, on p. 476, he says, as above quoted, the "*illuminating oil* had a singularly low fire test," and that he was so much pleased with the results obtained that they despatched a gentleman down to Kentucky and Tennessee to try to obtain a *large quantity* of an article which yielded illuminating oil with a bad odor at so much trouble and expense that he abandoned it as not being useful to them, thinking no more about the matter.

One witness has been brought forward to corroborate Dr. Tweddle's statements as to this Barren County oil, with what success we must now inquire. This witness is Joseph Clark, who was in the employment of Dr. Tweddle at the time this oil was operated on. At another place we shall have to examine this man's credibility as a witness, but at present we shall consider his testimony without comment as to his relations to the case as a witness.

On p. 283, ints. 75, 76, he supplies one fact about the residuum oil of the second distillation which Dr. Tweddle says was like Merrill's oil, and which the doctor could not give. He is asked,—

"*Int.* 76. What was the character of the oil remaining in the still?
"*Ans.* It was a heavy, dark-yellow oil."

Again on p. 283, when asked (int. 88) to state as nearly as he can the gravity of the residuum oil of the second distillation of that oil, he says,—

"I don't remember the gravity of it now, but I know it to be a rich, heavy oil, heavier than that Dr. Tweddle now makes, of a dark-amber odor."

Again, on cross-examination, p. 288, he is asked (int. 66) what was the gravity of the residuum oil of the second distillation, and he says:—

"I don't remember of testing to ascertain its gravity; it was a *very heavy* oil."

Now, Merrill's oil is not a *very heavy oil*, neither is it of a *dark-yellow color*. It is very clear that the oil the witness is speaking

must have had these characteristics, for only eight or ten barrels of it was obtained from two hundred and forty barrels of crude oil, or less than five per cent, and the evidence shows abundantly that so small a quantity of residuum must have been both heavy and dark. Dr. Tweddle himself says that the distillation was allowed to proceed till the oil running from the condenser was "*very yellow*" (p. 163); and it has been abundantly proved that the oil remaining in the still is much heavier and darker than that coming over through the condenser.

Again Clark says that the illuminating oil produced at the first distillation was from sixty-five to seventy per cent of the two hundred and forty barrels of crude oil, say one hundred and sixty barrels, and that its gravity was about forty-six; that the heavy oil of the first distillation was run in with the light oil, making the quantity greater and the gravity greater, and yet that the residuum of the second distillation, which is claimed to be Merrill's oil, was in quantity about eight or ten barrels.

Pages 285 to 288.

The residuum could not therefore have exceeded six per cent of the oil distilled at the second distillation, and the evidence abundantly shows that such a percentage of residuum must have been both heavier and darker than Merrill's oil.

Merrill, pp. 416 to 420, ints. 13 to 20.

It is important to observe that neither Tweddle nor Clark claims that this oil was like the Neutral Topaz Oil.

Is there anything in all this testimony from which the Court can infer that this oil had the properties, or could be used for the purposes of either Merrill's oil or Tweddle's?

Invention embraced in Prior Patents.

Third. But the most important allegation made in relation to the prior invention by Tweddle is, that the invention is described in a patent granted to him in 1862, and in a reissue thereof in 1866; and that his Neutral Topaz Oil is made in accordance with a process described therein, and also in a patent granted to him Dec. 10, 1867, and numbered 72,126; and that, in the summer and fall of 1867 he manufactured such oil by such process.

We will first consider the patents. The patent of 1862 (Record, p. 538) alleges that Tweddle "has invented a new and useful improved apparatus for distilling coal oil and other substances."

The statements in the specification of the nature of the invention are as follows: —

"Be it known that I, HERBERT W. C. TWEDDLE, an *Alien* and *Subject* of the *Queen* of *Great Britain* and *Ireland*, have invented a new and useful improvement in the *Apparatus* for distilling petroleum or any other Hydro-carbon Oil or Fats of any description, and I do hereby declare that the following is a full, clear and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification." (p. 2, sup. rec.)

After the usual reference to the drawings, there follows this statement of the nature of the invention: —

"The nature of my invention consists in an *apparatus* for distilling Petroleum or any other Hydro-Carbon Oil or Fats of any description, by means of super-heated steam, so that fire is dispensed with in proximity to the still, thus rendering the process of distillation much safer than in the usual mode, and insuring permanent soundness to the still and pipes."

After describing the apparatus, which includes pipes for discharging steam into the oil in the still, and an arrangement for producing a vacuum by means of a jet of steam discharged from a pipe in such a manner as to act upon the vapors and gases in the condenser and still by induction to remove them, there follows the description of the operation, and then this further statement of the object of the improvement: —

"The object of my improvement is to preclude the necessity of having fire in or near the building in which the operation of distilling is carried on, and to do that which has been hitherto attended with considerable danger, perfectly safe.

obviates besides the continual annoyance and derangement of the business, which frequently occurs in the old mode by the cracking or burning out of the still, leakage of pipes, etc. No leakage from defective joints can possibly occur so that the gas would escape, as the pressure of the atmosphere from without is greater than the internal pressure.

"Another advantage is having the products of distillation received in the immediate vicinity of the still, so as to have the whole operation under the eye of the workman. The apparatus can be arranged with any still without any derangement of the former.

"The coil in the interior of the still is for the purpose of heating the oil up to distilling temperature. The blow pipe is used when the operator thinks it desirable."

And finally the claims are as follows: —

"*First.* I claim the vacuum apparatus R, with which by the use of steam I produce a vacuum.

"*Second.* The use of the vacuum apparatus R, arranged substantially as described, in combination with the receivers L and M, or their equivalents.

"*Third.* The use of the vacuum apparatus R in combination with the steam pipe F, arranged in the interior of the still, substantially as described."

There is not a single reference in the patent to lubricating oils or paraffine oils or heavy hydrocarbon oils, and of course not to any improvement of them. There is no suggestion, even, that improved oils of any kind are produced by this apparatus.

There is no suggestion that he is the first to use a vacuum; and his claims are clearly limited to the special means described for producing a vacuum, and to a combination of that means with other parts of the apparatus. He says nothing of superheating the steam used, and shows no means for superheating it.

Can the Court read in the specification of this patent, which does not even mention lubricating oils, a description of Dr. Tweddle's Neutral Topaz Oil, or of the process of producing it?

We pass to the reissue of this patent, dated Nov. 27, 1866, and printed on p. 541 of the Record.

It requires but a slight examination to see that it contains many things not contained in the original patent. The specification starts with a statement that the invention is an improvement in the *process* of distillation of petroleum and other hydrocarbon oils, instead of ...g for an improvement in apparatus, as in the original patent;

and it describes the use of superheated steam at certain stages of the distillation, no reference being made to such use in the original patent. But as the validity of this reissue does not concern us in this case, and as we are interested in it only as it is claimed to furnish evidence of a prior knowledge at the time of Merrill's invention, we shall consider it just as we would consider an original patent of that date, with a view to ascertain what the patentee in fact knew at that time.

With this view we introduce the following extract, not contained in the original patent, and which contains the only reference to the heavy products of the distillation of petroleum found in either the original or reissue.

"If the process of distillation is carried on under a vacuum (or partial vacuum), the heat required is considerably less, being only about 380° Fahrenheit, in cases where 580° would be required without the vacuum. To obtain the degree of heat (say 380° Fahrenheit) required at the latter stages of the process of distillation by the use of steam, it is necessary to have a pressure of about 200 lbs. to the square inch in the steam generator, which is fraught with danger, and is liable to injure the steam pipes and stills, and cause leakage. Thus, although the heat produced by steam is much more beneficial, so far as the effect on the distillate is concerned, the difficulty and danger attending the production of the high temperature required at the latter part of the operation, even if a vacuum is created in the still, renders its adoption in this way unadvisable. By superheating the steam, however, this difficulty is effectually surmounted, because much less pressure is required, so that, by the use of superheated steam in combination with a vacuum or partial vacuum, *I am enabled to distil even the heavy products of distillation* of petroleum and other oils, and at the same time avoid, in a great degree, *the decomposition of the oils into non-condensable gas*, and the elimination of solid carbon, in the shape of coke or tarry residuum, which is deposited in the bottom of the stills when fire heat is employed. The apparatus employed may be variously constructed and arranged, and the vacuum may be produced by means of an air pump, water column, or by means of the device hereinafter described."

It may, perhaps, be claimed that the passage we have italicized shows that he expected to obtain, by distillation with the use of superheated steam and a vacuum, a heavy product. But he says nothing in terms about the nature of such product, and is far from describing his Neutral Topaz Oil as he describes it in his patent of 1870, or in his testimony, or as it is described by the other witnesses in the case.

Again, it may, perhaps, be claimed, not only that in the passage referred to he speaks of a heavy oil product produced by the distillation, but that such distillate would have the character described in a subsequent passage, as follows (p. 544) : —

"In addition to the advantages already stated as resulting from my improvement, the oil resulting from distillation by the process described is almost entirely devoid of the acrid and unpleasant odor of fire-distilled oils, and is almost colorless."

But the very next passage shows that he here refers to illuminating oils only as the product of the process described by him. The passage is as follows : —

"The quantity of illuminating oil thus produced from a given amount of crude petroleum is greater by from twelve to fifteen per cent by my process."

Now, as the evidence shows that an increased quantity of illuminating oil can be obtained from petroleum only by decomposing or cracking the oil, this passage shows conclusively that when in the first passage quoted he speaks of distilling the heavy products of distillation of petroleum, he speaks of the residuum products which are subjected to distillation, and not of products produced by distillation by his process.

But this is made perfectly clear by another passage in the specification preceding the two last quoted, and which is clearly a part of what is referred to in them when speaking of the results from the *process described*. This passage is as follows : —

"By means of the withdrawal or reduction of the atmospheric pressure thus effected the distillation progresses very rapidly at a low temperature compared to that which would otherwise be required. When all the oil is distilled which will pass over at the heat first employed, I increase the temperature up to about 120 lbs. pressure to the square inch, after which I commence to use superheated steam, by which means I can safely attain any degree of heat which is requisite to distil the heavier oils remaining undistilled at the degree of heat previously employed."

This shows clearly that he contemplated distilling over the heavy oils and by this process obtaining twelve or fifteen per cent more of illuminating oil.

We are justified in saying that in the reissue, as in the original, here is no reference whatever to the production of lubricating oils.

It is curious to observe that, in speaking of the character of the products of the distillation, he makes no reference to the absence of the green and blue tints, on which he lays so much stress in his patent of 1870 and in his testimony. The reason probably is that he never used such an apparatus as that described in these patents. He nowhere states in his testimony that he ever built or used such an apparatus, or that he knew by trial what results could be obtained from it. What he says in this reissue about the product of the process he described being free from acrid and unpleasant odors and from color was unquestionably a mere guess, and could not be treated as a prior knowledge of anybody's invention, even if it had been subsequently proved to be true, which it has not.

The statement in this reissue of the nature of the invention refers to nothing more than the use of a vacuum, or partial vacuum, in combination with the use of steam, as the following extract will show: —

"Be it known that I, HERBERT W. C. TWEDDLE, a citizen of England and a resident of Pittsburg, in the State of Pennsylvania, have invented a new and useful improvement in the *Process* of distillation of Petroleum and other hydro-carbon oils or fats of any description. . . . . .

"My invention consists in distilling petroleum and other hydrocarbon oils and fats, under a vacuum, or partial vacuum, in combination with the use of steam for producing the vaporization of the article to be distilled. Also in the use of super-heated steam for distilling hydrocarbon oils and fats under a vacuum or partial vacuum.

"The principal objects of my invention are to conduct the operation of distillation at a lower and more uniform degree of heat than is required by the ordinary modes of distillation, and to remove the danger arising from the direct application of fire to the stills containing the oil to be distilled."

The claims, so far as they relate to the process and not to the apparatus, are to the same effect, viz.: —

"1. Distilling hydrocarbon oils, such as petroleum and other substances, under a vacuum or partial vacuum, by the use of steam for producing the vaporization of the article to be distilled.

"2 The use of super-heated steam in combination with the employment of vacuum or partial vacuum, for the distillation of petroleum, and other hydrocarb oils, and similar substances."

And by this process, which he then sets forth, he says he produces from twelve to fifteen per cent more illuminating oil.

An increased production of illuminating oil is the result he secures, and not the production of a better lubricating oil.

Again we ask, Can the Court read in the reissued patent, any more than in the original, a description of Merrill's oil or of Tweddle's Neutral Topaz Oil, or of the mode or process of producing them?

The patent of Dec. 10, 1867, remains to be examined. It will be found on p. 545 of the record. The answer does not allege as to this patent, as it does in respect to the two just considered, that Merrill's invention is "described and patented therein"; but only that the Neutral Topaz Oil sold by the defendant was "manufactured by the said Tweddle according to a process invented by himself," "and fully described and patented in his said patent of Feb. 4, 1862, reissued Nov. 27, 1866, and also in Letters Patent granted to him Dec. 10, 1867."

The specification of this patent commences with this statement of the nature of the invention: —

"The nature of my invention consists in distilling hydrocarbon oils by causing the oil to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum still, with or without the application of superheated steam, and in securing a continuous and complete distillation of such oils by causing them to flow over the surfaces of a succession of such pipes in different stills, the temperature of the pipes increasing in each successive still, so as to drive off first the more volatile ingredients, and then those less so, and so on, until only the residuum remains; also in the application of such process to the re-distillation of fire-distilled, residual, and lubricating oils.

"This process of distillation may be carried on in various ways, but the devices which I find most convenient therefor I will proceed to describe, to enable others skilled in the art to make use of it."

There follows then a description of apparatus, which consists of series of pipes, one above another, heated by the introduction of , and over which the oil to be distilled flows, dropping from

one to the other, the heated surface of the pipes thus operating upon the film of liquid covering the pipes, instead of upon a mass of liquid occupying the body of the still; together with means for introducing superheated steam into the body of the still so as to come into direct contact with the oil flowing over the pipes. A series of such stills are so arranged that the residuum, or the oil not distilled in passing over the pipes, passes from the bottom of the still into another of the same construction, where it again passes over hot pipes arranged and operating in the same way. A copy of one of the drawings of the patent, hereto annexed, shows this novel arrangement of the stills and pipes.

The process of distilling by this apparatus is described as follows (p. 546): —

"The petroleum to be distilled, either crude or deprived of the gasoline or other more volatile ingredients, and either cold or in a heated state, as may be deemed advisable, is admitted through a cock b', at the side of the still, B, into a pipe, b, which, running transversely across over the troughs, a', discharges through a perforation over each such trough, as shown in Fig. 2, the oil in such perforated and serrated troughs, a'. Through the perforations in each trough, a', the oil runs down, gathers on the points of the serrated edges, c, whence it falls on to the steam-pipes, a, dropping or running from pipe to pipe, and passing in a thin film over the surfaces of such pipes. A current of dry or superheated steam, passing in at the valves $x\,x$, keeps such pipes, a, heated to a high temperature. Consequently the drops or streams of oil, coming in contact with them and passing over them, are subjected to the action of a heated surface relatively large, which causes it to volatilize with great rapidity, the more so as the pressure of the atmosphere is already removed from the inside of the still by the air pump, as hereinbefore stated. Fluids in motion also, it is well known, vaporize more rapidly than fluids at rest, so that by causing the oil to flow over heated surfaces in a vacuum, I secure an exceedingly rapid evaporation. I also facilitate this process by bringing jets of superheated steam from the pipes e in contact with the oil while flowing over the surfaces of the pipes a. A serrated edge may be placed under each such pipe, a, to secure a more even distribution of the oil in its flow from pipe to pipe. Steam is admitted to the pipes e through the valves $x^1\,x^1$, and the water of condensation drawn off from the pipes a and e by the cocks $x^2\,x^2$. By the use of these devices, the lighter or more volatile oils are driven off in the first still, B, in the form of vapor, which, being carried over by the goose-neck, B^1, to the condenser, B^2, is there condensed, as presently to be described. Such of the heavier oils as are not thus vaporized in the first still, B, fall to the bottom of the still, whence by a pipe, f, they are conducted into the next still, C. There they are discharged into perforated and serrated troughs, a', flow on to and over pipes, a, and other volatile ingredients are

H. M. C. Treddle

Impd Apparatus for Distilling Petroleum &c.

Patd Dec. 10. 1867.

No 72. 125.

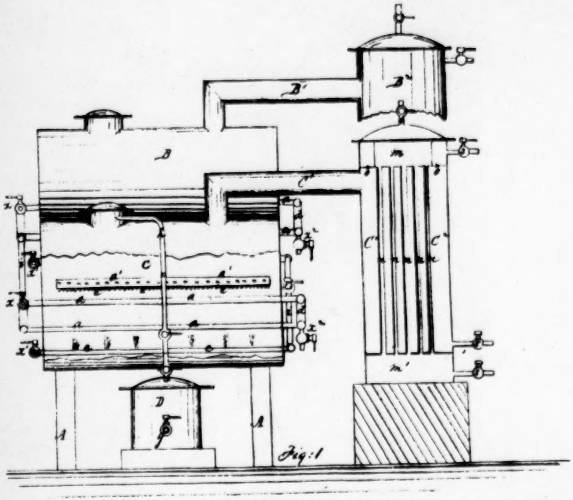


Fig: 1

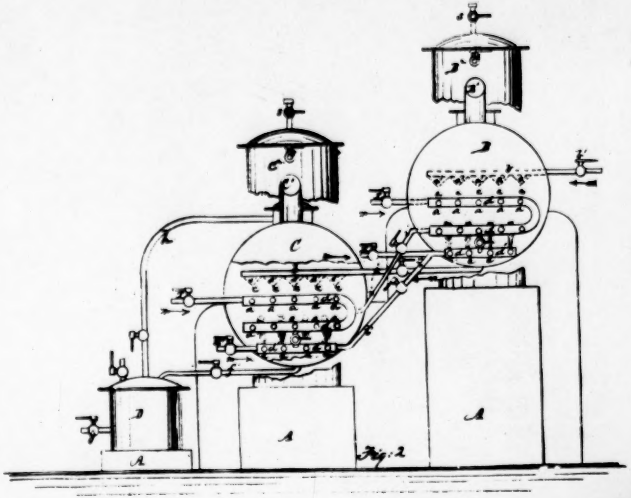


Fig: 2

off in vaporous form by an increased degree of heat received therefrom, and from the superheated steam which escapes from the jet-holes, in the pipes, *e*, in the manner already described. The *residuum*, with the *oils not yet volatilized*, if any, falls to the bottom of the still, C, whence it is conducted to another still and similarly treated, or by a pipe, *f'*, is discharged into a receiver, D, in which a vacuum is also preserved. From this it is drawn off by a cock, *g*, at pleasure A pipe, *h*, connects the receiver, D, with the still, C, for convenience in securing a vacuum in the former, and for the purpose of conducting over any vapors which may arise from the RESIDUAL MATTER in such receiver.

"The steam used in this process may be admitted into the pipes *a* and *e* of each still separately, or it may be first admitted into the pipes *a* and *e* of the last and lowest of such stills, and conducted thence by pipes *i i*, into pipes *a e* of the next still, and so on till the last or highest still is reached. In this way I apply the steam when hottest to volatilizing the heavier oils, which of course require for that purpose the greater degree of heat; and as the temperature of the steam is reduced in its passage from still to still, I apply it at a lower temperature to driving off the lighter oils in each higher still; or, in other words, I secure a continuous and complete distillation of hydrocarbon oils, by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier ingredients by a higher degree of heat, passing the *residual oil* for that purpose from still to still, so as to subject it to a constantly increasing temperature in the successive stills, till only the residuum remains. Superheated steam may, if preferred or found necessary, be used in the pipes *a* as well as in the pipes *e*. *By the use of this process* I render unnecessary the application of fire or fire-heat directly to the oil at any state of the distillation, *whereby I avoid all possibility of a fire or an explosion*, which are the chief sources of danger in the distillation of hydrocarbon oils."

After thus describing the process, he sets out its advantages in the following terms (p. 547) : —

" The advantages of this process of distillation are, among others, first, dispensing entirely with the application to the oil of fire or a fire-heat, as already stated; second, a more rapid vaporization of the oil; third, collecting the vapors of the lighter and heavier oils and condensing them, in separate receivers, *whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients which render them dangerous in use at the temperatures to which, in such use, they are necessarily raised;* fourth, a continuous and *more complete* distillation of the oil than can be secured by the ordinary process; fifth, a cheaper process of distillation; and, sixth, the production of a better article."

After describing these advantages and results as applied to crude petroleum, the specification proceeds as follows : —

" As a further part of my improved process, I take oil produced by distilling by fire (the process ordinarily in use), and re-distil it *in vacuo* substantially as above described. Unrefined fire-distilled oil has a disagreeable odor and a bad color, to remove which the oil is generally treated with acids, alkalies, etc. My process of

distillation obviates the necessity of refining the oil, with a consequent saving of time, trouble, and expense, and also produces an article superior in quality to the common fire-distilled refined oils. I also apply my improved process to the distillation of the *residual and lubricating oils produced* by fire-distillation, with the same benefits as above set forth.

"In carrying on the process of distillation above set forth, I do not limit myself to the particular devices described."

Now it is obvious that while the patent of 1862 describes and claims an *apparatus* for distilling by means of a vacuum and steam introduced directly into the still, and the reissue claims *the process* of so distilling, the patent of 1867 describes a new apparatus for distilling oil in connection with a vacuum and steam as it passes in a film over heated pipes, and suggests its use not only in the distillation of crude, but in the re-distillation of fire-distilled oils and the distillation of residual and lubricating oils produced by fire distillation.

The claims are in harmony with this statement of the invention, and are as follows (p. 548) : —

"1st. In distilling hydrocarbon oils, vaporizing the oil by causing it to flow in film or layer over the surfaces of a series of heated pipes in a vacuum-still, with or without the application of superheated steam, substantially as above described.

"2d. The application of the process of distillation, hereinbefore described, to the re-distillation of fire-distilled oils, for the purpose of producing an oil *similar to the refined oil of commerce*, substantially as above set forth.

"3d. Securing a continuous and complete distillation of hydrocarbon oils, by causing the oil to flow over the surfaces of a succession of heated pipes in different vacuum stills, the temperature of such pipes increasing in each successive still, so as to drive off at first more volatile ingredients, and then those less so, and so on till only the residuum remains, substantially as hereinbefore described."

We should observe here that the term "refined oil" applies exclusively to illuminating oil, and that the term "refining oil" applies to its treatment with chemicals after distillation.

Merrill, p. 424, ints. 34, 35.
Stipulation, p. 204.

Now, it will be observed that in describing the distillation of crude petroleum the specification states that the oil first passes into a still, where its lighter or more volatile oils are drawn off, while the heavier oils not distilled pass into a second still at a higher tempera-

ture, where other volatile ingredients are distilled off, the undistilled oils or residuum passing into another still in turn, at a yet higher temperature, to be again passed over the heated pipes, and so on till nothing but residuum remains. The drawings and description show a condenser at each still, and as the oils condensed in the successive stills would increase in gravity, it may be claimed that the product of the last stills would be lubricating oils, although no reference is made to any such product. But there is a statement near the end of the specification which speaks of the products, and speaks of illuminating oils only. It is found in the statement of the advantages of the new process, which we quote again in full, italicizing the passage we particularly refer to: —

"The advantages of this process of distillation are, among others, first, dispensing entirely with the application to the oil of fire or a fire heat as already stated; second, a more rapid vaporization of the oil; *third, collecting the vapors of the lighter and heavier oils and condensing them in separate receivers, whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients which render them dangerous in use at the temperatures to which in such use they are necessarily raised;* fourth, a continuous and more complete distillation of the oil that can be secured by the ordinary process; fifth, a cheaper process of distillation; and sixth, the production of a better article" (p. 547).

So far, at least, illuminating oils are the only products referred to. The reissued patent of 1866 claims that by the use of steam and vacuum the quantity of illuminating oil could be increased from twelve to fifteen per cent. This patent claims that by the use of the peculiar arrangement of pipes described and by a succession of stills into which the undistilled portion of the oil passed, and by the use of separate condensers with each still, he obtained, among other advantages, an *illuminating* oil free from the volatile oils which render them dangerous. But there is not a word said in either patent about the production of lubricating oil of a better quality, or even of any quality. There is not a hint of Neutral Topaz Oil in the patent. Certainly the patentee does not allege or suggest that by distilling crude petroleum in the manner described he can produce a lubricating oil having the qualities of his Neutral Topaz Oil or Merrill's deodorized oil; and in this connection it is important to remember that in his patent of 1870, for producing

Neutral Topaz Oil, he describes the use of crude petroleum only, and does not refer to the use of heavy hydrocarbon oil.

There remains one further inquiry in respect to this patent. Does it describe the application of the process of dripping the oil over pipes, as specified in the patent, to heavy hydrocarbon oils, or indeed to any other oil, to produce an oil like Neutral Topaz or Merrill's oil?

There are two references to the application of the process to other oils. The first is found in the italicized portion of a passage already quoted, from near the commencement of the specification: —

"The nature of my invention consists in distilling hydrocarbon oils by causing the oil to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum still, with or without the application of superheated steam, and in securing a continuous and complete distillation of such oils by causing them to flow over the surfaces of a succession of such pipes in different stills, the temperature of the pipes increasing in each successive still so as to drive off, first, the more volatile ingredients, and then those less so, and so on, until only the residuum remains; *also in the application of such process to the redistillation of fire-distilled, residual and lubricating oils.*" (p. 545.)

The other is found near the close of the specification, and is as follows: —

"As a further part of my improved process, I take oil produced by distilling by fire (the process ordinarily in use), and re-distil it *in vacuo* substantially as above described. Unrefined fire-distilled oil has a disagreeable odor and a bad color, to remove which the oil is generally treated with acids, alkalies, etc. My process of distillation obviates the necessity of refining the oil, with a consequent saving of time, trouble and expense, and also produces an article superior in quality to the common fire-distilled refined oils. *I also apply my improved process to the distillation of the residual and lubricating oils produced by fire distillation with the same benefits as above set forth.*" (p. 547.)

It is obvious that the fire-distilled oils, spoken of near the end of the first quotation, are illuminating oils which have not been subjected to refining process by chemical means; and that in the second passage the patentee speaks of the application of his process to such oils as a substitute for refining by chemical means, stating that by so doing he produces an article superior in quality to the common fire-distilled *refined oils*.

We have already stated that the term "refined oils" is applied exclusively to illuminating oils.

There is no statement as to what the oils were which are produced by the distillation of what are termed the residual and lubricating oils. Certainly there is no suggestion that such oils as Dr. Tweddle's Neutral Topaz, as described in his patent of 1870, or Merrill's deodorized oil, as described in his patent, would result from the application of this process to these residual or lubricating oils, whatever they might be. And it certainly does not follow as a matter of course that lubricating oils of any kind would be produced by such distillation, for it is abundantly proved by evidence in the case that the heavy oils, lubricating oils, or residuums of whatever kind are commonly distilled for producing illuminating oils.

In his answer to the 181-t interrogatory, p. 190, Dr. Twedd'e states what he means by residual oils, in the passage just quoted from the commencement of his patent.

The question and answer are as follows: —

"*Int.* 181. In your patent of December 10, 1867, No. 72,126, you say, 'I also apply my improved process to the distillation of the residual and lubricating oils produced by fire distillation.' What do you mean there by residual oils?

"*Ans.* By residual oils I mean those oils which run from fire stills (whether steam or superheated steam is used as an auxiliary or not) at the latter end of the distillation. If the oils are run rapidly from the still, then the oils are yellow, of heavy gravity, from about 34° to 38° Baumé, and contain more or less paraffine. They are unsuitable to mix with the burning oils. It was my practice, from 1861 to 1866, to introduce into fire stills, towards the latter portion of the distillation, the superheated steam more freely than in the earlier part of the distillation, for the purpose of preserving the bottoms of the stills from the action of the intense heat of the fire; and consequently I made a good deal of this residual oil, *which I consider is the same as the No. 2 oil mentioned by Mr. Merrill in his answer to the first cross-interrogatory.* It is the usual practice now, in fire distillation, instead of running stills rapidly at the latter end of the distillation, to run them slow, and decompose the oil in the still producing burning oils of very light gravity, sometimes upwards of 60° Baumé. They are light in color and make good burning oils."

Now, if he used the term "residual oil" in the sense here given, that is, as applying to an oil distilled over and condensed, he certainly used it in a different sense from that in which he used the

same term in two or three other places in the same patent, where it clearly applies to the undistilled oil remaining in the still.

Thus he speaks in one passage, on p. 547 of the Record, as follows: —

"Or, in other words, I secure a continuous and co nplete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier ingredients by a higher degree of heat, passing the *residual oil* for that purpose from still to still, so as to subject it to a constantly increasing temperature in the successive stills, till only the residuum remains."

Again, he says: —

"It is not absolutely necessary that one still should be higher than another, since by creating a more complete vacuum in the second still than in the first, and so on in each successive still, the *residual or unvaporized oil* in the bottom of each still may be forced into the next at the same or a higher level."

And in another passage, on p. 547, he speaks of the undistilled oils when carried into a receiver as residual matter: —

"A pipe *h* connects the receiver D with the still C, for convenience in securing a vacuum in the former, and for the purpose of conducting over any vapors which may arise from the residual matter in such receiver."

In the answer which we have quoted, he describes the residual oil referred to in the passage there quoted from his patent as a distillate similar to oil which he was in the habit of making while at the Standard Works, and similar to Merrill's No. 2 oil, in connection with which the accident happened which led to Merrill's invention, as described by Merrill in his answer to the 12th interrogatory, p. 51.

Apparently Dr. Tweddle means to suggest that because in his patent he speaks of redistilling this residual oil, he should, if he did so, produce Neutral Topaz Oil.

It is only necessary to observe that the oil which he describes as residual oil, whether made by himself or Merrill, was not a lubricating oil, and that it does not appear that either in his own practice or in Merrill's it had, when distilled, produced a lubricating oil. On the contrary, upon redistillation the product distilled over was a burning oil.

Its mention, therefore, in the patent, would not justify the conclusion that either Neutral Topaz Oil or Merrill's deodorized oil would

be produced by the application to it of the process described in the patent; and there is not the slightest evidence that either Dr. Tweddle or anybody else ever did produce Neutral Topaz Oil in that way.

In Merrill's patent the oil which he describes as heavy hydrocarbon oil, from which he produces his patented oil, is certainly not the oil which Dr. Tweddle, in the answer quoted describes as residual oil.

But if in his patent the term "residual oil," in the passage quoted, has the meaning he says it has in his answer above referred to, he not only used the term in a different sense from that in which he used it in the other passages quoted, but also in a sense entirely different from that in which it is commonly used.

See Merrill's dep., p. 425, ints. 38, 39.

So far, therefore, as the language of this patent is concerned, we are justified in saying that it does not describe the production of an oil such as Dr. Tweddle describes his Neutral Topaz Oil to be in his patent of 1870, or such as, in fact, the Neutral Topaz Oil is proved to be by the evidence in this suit.

We turn now to consider what evidence there may be that Neutral Topaz Oil could be produced by means of the apparatus described in the three patents of 1862 and the reissue, and in the patent of Dec. 10, 1867.

The evidence comes wholly from Dr. Tweddle himself. No other witness has been examined either to show that he had seen Neutral Topaz Oil produced by following the directions of these patents or to give his judgment that it could be so produced.

And all Dr. Tweddle says upon the point is as follows: —

"*Int.* 220. State whether or not the results described in your patent of Feb. 15, 1870, No. 99,975, can be produced by following the process described in your patent of Dec. 10, 1867, No. 72,126.

"*Ans.* The illuminating oil, the paraffine or neutral topaz oil and residuum can be produced by following the process described in the patent of Dec. 10, 1867, the same as they can by the patent of Feb. 15, 1870, No. 99,975.

"*Int.* 321. State whether or not the results described in your patent of Dec. 10, 1867, No. 72,126, can be produced by following the process and using the apparatus described in your reissued patent, No. 2,404, dated Nov. 26, 1866, being a reissue of the original patent, No 34,324, dated Feb. 4, 1862.

"*Ans.* They can be produced."

Record, p. 233.

The first observation to be made on this testimony is that it is entirely equivocal; for the patents referred to, so far as they relate to processes, describe, first, the use of a vacuum and of steam thrown into the body of the still; and secondly, in connection with such vacuum and steam, the distillation of the oil while it is flowing over heated pipes.

And all that the doctor's testimony amounts to, when read along with the patents, is, that Neutral Topaz Oil may be produced by distilling *in vacuo* and by the aid of steam, or in connection with these that it may be so distilled when flowing over heated pipes.

But it by no means follows that such oil can be produced by using these means *in the manner described in his patents*; and it is evident that Dr. Tweddle himself could not have thought so when he applied for his patent of 1870; for he there makes the following claim in respect to his Neutral Topaz Oil: —

"2. The production, by the process hereinbefore described, of a lubricating oil as a new article of manufacture, possessing the distinctive and distinguishing features above set forth, viz., almost entire freedom from the blue and green tints which characterize the paraffine oils of commerce,"

Page 448,

That this process differs from the process described in the previous patent he must certainly have believed when he claimed the production of his Neutral Topaz Oil by a process described in that patent as a new article of manufacture, after stating in the specification that the oil "is a specific product of this mode or process of manufacture, *and cannot be made in any other way.*"

The process for producing his Neutral Topaz Oil described in the patent of 1870 must have been different from that described in the patents of 1862, and the reissue, and the patent of 1867, or he could not have truthfully made oath that it was a new invention.

It is true that he can produce Neutral Topaz Oil by distilling with steam and under a vacuum, and perhaps, also, when allowing the oil to flow over pipes in the manner described in the patent of 1867. But there must have been something over and above all this in the process described in the patent of 1870 to justify the patentee in claiming the production of Neutral Topaz Oil by such process, as a specific result of such process, and as a result which could be produced by no other process.

The patent of 1870 contains, at its commencement, this statement (p. 446) : —

"My invention relates to the distillation of petroleum or other hydrocarbon oils, which can be made to yield a considerable percentage of paraffine, and consists in so carrying on the process of distillation that little or none of the paraffine will be decomposed, but most or all of it will pass over as vapor and condense in the distillate, from which it may then be separated by cold and pressure."

This passage is succeeded by another as follows : —

"Previous to the date of my invention, the efforts of oil manufacturers were chiefly directed to securing from the crude oil the largest possible percentage of illuminating oil, in which oil the presence of paraffine was objectionable."

He then goes on to show how manufacturers were accustomed to proceed in order to secure the largest percentage of illuminating oil, stating that when from forty-five to sixty per cent of the crude oil was distilled over, the product became yellow and objectionable in odor, and, as other testimony in the case shows, was of heavy gravity and unsuitable for illuminating oil.

He then points out that at this stage of the distillation, various means had been resorted to for decomposing the heavier oils, which contain paraffine, and changing them into oils of lighter gravity and color, thus attaining the object Dr. Tweddle says they had in view, of securing the largest possible per cent of illuminating oil.

After describing at some length this process and its results, he

makes the following statement in regard to his own invention (p. 446):—

"My improved mode for producing paraffine and lubricating oil is, as a process, *directly the reverse of that above described.* Instead of decomposing the paraffine, I so carry on the distillation as to prevent such decomposition as far as possible. In this process I distil with a comparatively low heat produced by free steam, superheated or not at pleasure, in a vacuum or partial vacuum, with or without a fire on the outside of still, by which means I am enabled to produce paraffine in large quantity, and a superior quality of lubricating oil, both of which are of marketable quality and in fit condition for use, requiring but little further chemical treatment."

He then goes on to describe his process, and states that he carries on the distillation, producing illuminating oil only until he has distilled over from thirty-eight to forty per cent of the crude material. And from that point, instead of conducting the process so as to decompose the oils and obtain the greatest per cent of illuminating oils, he conducts it *so as not to decompose the oils and so as to obtain the largest per cent of heavy or paraffine oils.*

Now in the reissued patent of 1866, in which he describes and claims the use of steam and vacuum, as distinguished from what he calls fire distillation, he alleges as one of the advantages of his process that it will produce *from twelve to fifteen per cent more illuminating oil, and of necessity so much the less paraffine oil.*

This shows conclusively that the process described in that patent was different from that of the patent of 1870, where the object was to produce the smallest quantity possible of illuminating oil and the greatest amount of paraffine oil.

Now if we turn to the deposition of William Atwood, we shall find that he testifies most explicitly that the proportions of illuminating oil and paraffine oil can be widely varied in stills of the same construction by simply changing the temperature at which the heat is applied and the rate at which the distillation is conducted.

Page 30, int. 60.
" 368, int. 1.

And, again, Atwood further states that where the stills are unlike in structure, but the temperature at which heat is applied the same, the product will be different, and the time occupied in the distillation will be different, thus showing that the processes of distillation and the products obtained may be varied without changing the form of the still or the mode of applying the heat.

Now, by the means described in the reissue patent of 1866, of distilling by steam and vacuum, Dr. Tweddle so conducted the process as to produce the largest possible percentage of illuminating oil; but he afterward ascertained that with the same means, steam and vacuum, he could so conduct the process of distillation as to produce widely different results; and such process is as clearly the reverse of the former process as it is of the process of fire distillation described by Dr. Tweddle in his patent of 1870, with which he contrasts his new process, because it is distinguished by a far wider difference in result.

The process which we have before described as the cracking process, by which the whole product of the distillation of petroleum is illuminating oil and a residuum of tar or coke, is clearly a different process of distillation from that in which the products are not only illuminating oil and residuum but a heavy oil containing paraffine, which may be separated from the heavy oil, thus giving four products, although these different results may be obtained in the same still and with the same means for applying heat.

Oils made by Tweddle under his Prior Patents.

We turn now from the consideration of the claim that Merrill's invention is described and patented in Tweddle's patents, to consider the allegation that Tweddle did in fact make his Neutral Topaz Oil in the use of the inventions described in the patents, before Merrill made his invention.

It is proved that in the spring of 1867 Dr. Tweddle erected a still at his refinery, called the Eclipse Refinery, at Sharpsburg Bridge. This was the first still erected at that refinery. It was of cast-iron, and though of a different form from those shown in the patent of Dec. 10, 1867, contained the same arrangement for using steam, and for dripping the oil over pipes heated by steam, as that described in the patent referred to. Connected with it were furnaces and boilers for generating steam and superheating it, and also a condenser and a vacuum pump. This still appears to have been ready for use about the last of May, 1867, and to have been used more or less during June, July, August and September. After that it was not used till about May the following year. Dr. Tweddle testifies that during the four months of June, July, August and September he distilled from 1,500 to 2,500 barrels of petroleum. An account of one trial of this still shows that it distilled fifty barrels in five hours, or at the rate of one hundred barrels per day. It was, therefore, used from fifteen to twenty-five days during the four months.

During the winter and spring following, Dr. Tweddle built two wrought-iron stills of the same form and arranged in the same manner as described in his patent of Dec. 10, 1867, and having the same arrangement of steam pipes and means for distributing the oil over the pipes, together with condensers, vacuum pumps and superheaters. While building these stills, Dr. Tweddle was not engaged in distilling oil. He appears to have commenced distilling about April or May, 1868.

At this time Merrill had been for some time engaged in manufacturing and selling his deodorized oil. And Dr. Tweddle does not pretend that he sold or made any finished Neutral Topaz Oil till the winter following.

Dr. Tweddle's testimony in regard to his manufacture of his Neutral Topaz Oil and its character, commences on p. 166, at the 94th interrogatory, where he states that he is the manufacturer of the Neutral Topaz Oil sold by the defendants. On p. 168 we find the following testimony as to the time he first produced it.—

"*Int.* 104. You have stated that you distilled burning oils from petroleum with superheated steam *in vacuo*, by the use of the first apparatus which you put up at the Eclipse Works: state whether or not you also obtained heavy paraffine or lubricating oil as a distillate.

"*Ans.* I did, as a distillate, produce paraffine oil, or neutral topaz oil, the same as I now do.

"*Int.* 105. When was it that you did this?

"*Ans.* In June, July, August and September, 1867.

"*Int.* 106. State whether or not you expressed the paraffine from this oil referred to in your last answer.

"*Ans.* I did, and made neutral topaz oil at that time.

"*Int.* 107. Will you please produce a specimen of your neutral topaz oil, to be marked as an exhibit in this case?

"*Ans.* I here produce it. (Marked, "*Respondents' Exhibit, No.* 54, *J. H B.*")

On the same page, in answer to int. 114, he describes the process by which he produces this oil, and on p. 174 (Int. 142) he repeats the description substantially, and adds "by pursuing my process of distillation by superheated steam *in vacuo*, I can't produce anything else but neutral topaz oil and burning oil."

If this be so, then we must understand that whenever, from his statement quoted above, he produced burning oil, he also produced paraffine oil as a distillate, and we should naturally understand that he expressed the paraffine from it and made Neutral Topaz of it, *at that time.*

At a later stage of his testimony he makes a statement which shows that the amount of paraffine oil from which the paraffine was expressed so as to actually produce Neutral Topaz was very small.

Thus, on p. 191, he testifies as follows:—

"*Int.* 187. When did you first introduce in commerce your neutral topaz oil?

"*Ans.* I sold, I think, small quantities for trial, in the fall of 1867, and introduced it into commerce in 1868.

"*Int.* 188. Why was it that it was introduced in commerce so late? and state also what line of the oil business you were in while you were at the Standard Works.

"*Ans.* At the Standard Works we made nothing but illuminating oil for commercial purposes. In the summer of 1867 I did not do very much business, and I had a demand for dark lubricating oil, for railroad and other purposes. I may have sold some of the topaz oil for trial. It was not an oil for which there was a great demand in this locality. In the winter, spring and summer of 1868, I was busy enlarging my works, and when I had finished doing so I commenced making neutral topaz oil regularly. I did not get my presses up till the winter of 1868 or 1869, when I pressed out the paraffine and introduced the oil into commerce."

On cross-examination, however (p. 209, int. 162), it appeared that in speaking of sales of Neutral Topaz in 1867, he must have referred to paraffine oil before it had been converted into neutral topaz by the removal of the paraffine; for he says that "in the summer of 1867 he made Neutral Topaz Oil, and sold and gave away some of it for the purpose of being tested with the paraffine in, for summer use." And when he is asked (int. 153) if all he sold or gave away in 1867 had the paraffine in it, he replies, "All, except a small quantity which I expressed on a small scale after freezing it."

On the redirect examination (p. 229), we get a definite statement of the quantity of paraffine oil which he produced in 1867, and the quantity from which the paraffine was expressed to produce Neutral Topaz.

"*Int.* 197. State as near as you can the quantity of neutral topaz oil, with the paraffine oil in it, which you produced in the summer of 1867, and also the quantity you produced in the summer of 1868, and also state what you did with the oil so produced which was not sold in either of those seasons.

"*Ans.* In the summer of 1867 I should say I produced between 100 and 150 barrels of neutral topaz oil with the paraffine in I kept almost the whole of this oil until I commenced running in 1868. During 1868, and before I had my presses ready to press, I had, I should say, five hundred barrels frozen, by natural cold, ready for the presses. I presume I also had some in tank. The oil made in 1867, I presume, was mixed up with the oil produced in 1868. . . . . .

"*Int.* 201. In your answer to the 163d cross-interrogatory, you speak of having, in the year 1867, expressed the paraffine from a small quantity of neutral topaz oil after freezing it; please state in what part of the year 1867 that was; about how much neutral topaz oil you so pressed; and how it was frozen and pressed.

"*Ans.* During the summer of 1867 I had taken up to my house about a bucketful of the paraffine oil, distillate, or neutral topaz oil, as I now call it. I froze it in ice and salt. I put it in cloths, and expressed the oil in an impromptu lever press. I took the product into my laboratory, which was in the house, attached to my photograph room. I made different experiments with it. I sunned some of it by exposure in my photograph basins on my porch."

Thus at length we get at the actual quantity of finished neutral topaz oil which he claims to have made before the date of Merrill's invention,— *about a bucketful.*

Now, what corroborating evidence has been produced to prove that Dr. Tweddle did in the summer of 1867 produce about a bucketful of Neutral Topaz Oil, and from 100 to 150 barrels of paraffine oil distillate from which the paraffine might have been expressed to make Neutral Topaz Oil?

Before entering on this inquiry let it be observed that enough appears from Dr. Tweddle's own testimony to show that the production of Neutral Topaz Oil, or the paraffine oil distillate from which the paraffine is to be expressed to produce the Neutral Topaz, does not necessarily follow from the use of steam and vacuum, for it appears that the whole quantity of this distillate produced in 1867 was from 100 to 150 barrels, while on p. 200, in reply to cross-int. 80, he says that during the four months he used the still, in 1867, he distilled not more than from 1,500 to 2,000 barrels of crude petroleum; but on p. 177, in answer to int. 164, he states that the proportion of Neutral Topaz, which he procures from crude petroleum, is from twenty-five to forty-five per cent.

Taking the smallest amount of crude petroleum mentioned, 1,500 barrels, and the smallest percentage, twenty-five per cent, and it would have produced 375 barrels of paraffine oil distillate, while in fact the quantity he produced did not exceed 150 barrels. At another place he gives the percentage of Neutral Topaz which could be obtained at fifteen per cent; but even this percentage would have given him 225 barrels of the paraffine oil.

Again, he gives the results of a trial of his still in September, 1867, from which it appears that 50 barrels yielded on that occasion seventy-four per cent of illuminating oil and twenty-two per cent of residuum oil and no paraffine oil.

It is clear, therefore, that the use of the cast-iron still did not necessarily involve the production of Neutral Topaz Oil or of the paraffine distillate from which it is expressed.

We return to the question, What corroborating testimony has been produced to prove that in the summer of 1867 Dr. Tweddle made about a bucketful of Neutral Topaz Oil and from 100 to 150 barrels of paraffine from which Neutral Topaz might have been produced?

One witness called is Joseph C. George, a carpenter, who worked for Dr. Tweddle in the summer of 1867 and in 1868, but he says nothing about any kind of oil. He says he superintended the construction of a warehouse, which was not completed till 1868, and that he built the presses for expressing the oil from the paraffine, and that they were completed about the time cold weather set in in 1868.

Valentine Holler is also called, who worked for Dr. Tweddle in 1868. He says nothing as to what was done by Dr. Tweddle in 1867.

Nothing said by these witnesses tends to prove that Dr. Tweddle made Neutral Topaz Oil in 1867.

Robert Hill is called to testify that sometime from June to August, 1867, Dr. Tweddle came to him with a vial of oil, which he wished him to try on his fastest machinery in his planing mill; that he told him that James Douglass up stairs had faster machinery, and that he went up and introduced him to Douglass; and that he saw the doctor and Douglass go to some journals and put some oil on. He then left them. All he can say of the oil is, it was a light yellow, and that the doctor said the price would be eighty or eighty-five cents a gallon.

He says he himself never used this yellow oil, but that he used Dr. Tweddle's green oil, and he identifies a certificate of the good character of this last oil, given by him in March, 1868, and printed on p. 248.

This witness certainly does not prove that Dr. Tweddle made Neutral Topaz Oil in 1867.

James Douglass himself is called as a witness, and he testifies that Dr. Tweddle brought him a vial of oil sometime from about the 25th of April to the 9th of May, 1867. He fixes the time by the fact that he tried the oil before he delivered some sashes for the warehouse, and these sashes he delivered on the 9th of May.

Pages 212, 413, ints. 7, 14.

He tried the oil, he says, and found it as good as lard oil, and the next day sent for two gallons, and when that was gone, in two or three weeks, he sent for a barrel, and he says that he has continued to use the oil ever since.

Hill stated that he took the doctor with his vial up to see Douglass some time from June to August, and that he fixed the time by his books.

Dr. Tweddle fixes the time when he commenced to use his still as the last of May or the first of June, 1867.

Page 164, int. 77.

But according to his own statement, the witness had some of the doctor's oil about a month before any was made. Perhaps the Court may conclude, from the answer to the twenty-first interrogatory, p. 270, that the witness had suffered mental injury, so that his recollection must be imperfect.

It is noticeable that the witness knows nothing of the price of oil purchased of Dr. Tweddle, and that he refers to his partner and clerk as the ones who attended to the purchases and kept the books. These books, or the bills he refers to, would have the date of purchases and the price of the oil, and this last would have fixed the character of the oil. The partner and the clerk, too, must have known the character of the oil, but they are not called as witnesses; neither is the evidence of the books brought forward.

But the witness testifies to one circumstance which shows conclusively that the oil the witness had purchased of Dr. Tweddle could not have been Neutral Topaz Oil, but must have been the residuum oil, which the doctor called his Eclipse Lubricating Oil.

In March, 1868, Dr. Tweddle issued a circular in relation to his oil which contained a certificate of this witness's firm, M'Kee & Douglass, and also one from the witness Hill.

This circular is found on p. 249, and is as follows: —

"PITTSBURG, PA., March, 1868.

"DR. HERBERT W. C. TWEDDLE:

"*Dear Sir*, — Since last fall we have been using your 'Eclipse Lubricating Oil,' and after subjecting it to the severest test, we are as well satisfied with it as that of the best lard oil.

"The machinery of our planing and saw mills is all rapid running, our circular saws making nearly four thousand revolutions per minute, and yet the journals are kept cool and free from 'gumming.'

"Yours respectfully,

"M'KEE & DOUGLASS."

In relation to the certificate the witness testifies as follows, p. 271: —

"*Cross-Int.* 5. Will you look at a note at the bottom of page 381 of the printed record, and the top of page 382, and state whether that is a certificate which your firm gave to Dr. Tweddle of the merits of his oil, which your firm was using in 1868?

"*Ans.* Yes, sir. Excepting that as to the date, we used it before that time.

"*Cross-Int.* 6. You used it also during 1868, did you not?

"*Ans.* Yes, sir; and used it all the time we could get it. We sent for a barrel of oil once, and Dr. Tweddle was away. We got a barrel at another place at the time, *what they called Duck Creek Oil*, and then we got it from Dr. Tweddle afterwards, I don't mind how often, till he was burned out, and we got no more of it from that time till this summer; we have got the second barrel of it now, since I found out that he had started his works."

There can be no doubt that this certificate refers to the oil which the witness commenced purchasing in 1867, to use on his circular saw, and that it was not Neutral Topaz.

He was using it on a saw making four thousand revolutions per minute, — an exceedingly rapid rate. He compares it with lard oil in the certificate as he does in his testimony. In both he speaks of using it on circular saws running at a high rate of speed, and of having subjected the oil to the severest test. He does not suggest that he ever purchased more than one kind of oil from the doctor. The circular refers to the machinery of the mill in a way which implies that the oil was used on it all, and in his deposition the witness says

(int. 7) that he was satisfied, from a trial of the two gallons, that it would run the saw and all the balance of the machinery.

Douglass, p. 268, int. 7.

It may be added that Joseph Clark, a witness already referred to, who was in the doctor's employment in 1867, testifies that M'Kee & Douglass had some spindle oil in May, but that the paraffine had not been expressed from it. It was not, therefore, Neutral Topaz Oil.

Page 281, ints. 53 to 59.

Archibald Kelley is another witness called in support of Dr. Tweddle. He sold the land to the doctor in 1866, on which the latter built his Eclipse Refinery, and he continued to reside in his house on the land sold till March, 1868.

Page 261, ints. 3, 4.

He does not appear to have been in the employment of Dr. Tweddle. He states that the doctor commenced using his still in the latter part of May, 1867 (int. 19, p. 262), and he describes the products of the distillations on pp. 262 and 263, as follows: —

"*Int.* 20. Did you observe the products of distillation by the use of this still?

"*Ans.* Yes, sir.

"*Int.* 21. What were they?

"*Ans.* The color seemed a little different; there was none of that blue tinge that there is in the usual process.

"*Int.* 22. What kind of oils were they?

"*Ans.* There was burning oil that came off first, then an oil of an amber color, which we called the lubricating oil. The burning oil was an oil like any of our burning oils, except that it had none of that green tinge or color. The lubricating oil was an amber color, a little milky when coming off the still.

"*Int.* 23. What was the character of the residuum in the still after the illuminating and amber-colored lubricating oils came off?

"*Ans.* Dark green, dirty green, I call it.

"*Int.* 24. State whether or not the oil in the still had any coke in it after the illuminating and amber-colored lubricating oil had been taken over.

"*Ans.* Well, I think not. I never was in the still at that time.

"*Int.* 25. What was the character of the odor or smell of the amber-colored lubricating oil which you have spoken of as produced by Dr. Tweddle's process?

"*Ans.* It had a smell, but not so much as that done in the old way of distilling.

All petroleum has a smell. To give the difference between the two, the one has a scorched, burnt smell, and the other has n't.

"*Int.* 26. Which has the scorched, burnt smell, and which has not, — that made by Dr. Tweddle's process or that made by ordinary fire distillation?

"*Ans.* That made by the ordinary fire distillation has the burnt smell."

This description certainly does not identify the Neutral Topaz Oil, for there are plenty of other oils which are amber colored; and his vague descriptions of the odor is certainly not enough to show that it was Neutral Topaz.

Dr. Tweddle himself testifies that he made in the summer of 1867 an oil which he called amber oil, from Smith's Ferry petroleum, which was odorless, or nearly so.

Page 174, ints. 145, 146.

It would be an easy thing for the witness, after the lapse of four years, to confound the oil which he thinks was produced as a distillate with this amber oil. Indeed, the witness shows by several mistakes in his statements, not so easily made as this, that his memory is not to be relied on,

For instance, on p 263, he testifies as follows about the erection of the two wrought-iron stills put up after the cast-iron still: —

"*Int.* 27. State whether or not Dr. Tweedle put up other stills after the one you have referred to, at those works, — when, and how many.

"*Ans.* In 1867, I think, he put up two more, and one more after that.

"*Int.* 28. What part of the year 1867?

"*Ans.* It was in summer, some time."

Now it is clearly proved by Dr. Tweddle and other witnesses that these stills were not built till the winter and spring of 1868.

On p. 263 he makes the following statement about the production of paraffine from the green residuum oil, from which it never was produced, showing that his memory is utterly unreliable: —

"*Int.* 37. You have spoken of the dark-green colored oil remaining in the still, as used by Dr. Tweddle, after the illuminating oil and the amber-colored lubricating oil was carried over: state, if you know, what this heavy green oil was used for.

"*Ans.* They made paraffine out of it.

"*Int.* 38. State whether you have seen any paraffine made by Dr. Tweddle.

"*Ans.* Yes, sir.

"*Int.* 39. State how he made it.

"*Ans.* He chilled the residuum and pressed it out.

"*Int.* 40. Are you sure that it was the dark-green residuum which Dr. Tweddle pressed to produce his paraffine?

"*Ans.* No, it was not the dark. It was more of a lighter color. What stage that came off I could not state correctly."

On the next day (ints. 48 to 51) he acknowledged that he made a mistake in saying that Dr. Tweddle produced paraffine from the green residuum, but at the same time made another, by saying it was done at other refineries.

In his answers to ints. 60 and 61, he says the paraffine presses were used before he left his house in March, 1868. But Dr. Tweddle himself, and George and Holler, testify that these presses were not put up till the fall of 1868, and were not used till the cold weather set in.

Tweddle, p. 229, int. 197.
George, p. 259, ints. 12, 13, 14.
Holler, pp. 266, 267, ints. 9, 10, 19, 20, 21.

Such a witness's statement as to date and shade of color, and the odor of an oil years before, cannot be relied on.

A bottle of Neutral Topaz Oil (Exhibit 84) is shown to him (int. 57), and he is asked "whether or not it corresponds with any of the oil which you saw made by Dr. Tweddle in the year 1867." And he answers, "Yes, sir. That is about the same. The same smell precisely." But as this answer did not identify the particular oil made in 1867, to which the sample corresponded, the counsel proceeded (int. 58), "Which oil do you refer to as being like the sample?" and he answers, "This is like the oil *they run from the paraffine in the pressing operation.*"

Well, they did not run any oil from the presses in 1867, for they did not have any presses till the latter part of 1868. And though after another effort by the counsel he is made to say that the sample is about the same as the oil as it run from the *still* in 1867,

we submit that his testimony is too loose to be regarded by the Court. Consider that the whole amount of this oil produced in 1867 did not exceed 150 barrels, and that, as the still was capable of distilling 100 barrels per day, yielding, as Dr. Tweddle states, not less than twenty-five per cent of this di-tillate, the whole 150 barrels could have been produced in six days, and it is clear that such a witness would be easily mistaken about things which must have been so little under his observation.

William W. Howard, an oil dealer and manufacturer of Alleghany City, testifies that in 1867 to 1870 he was a partner with James Dalzell & Sons, oil dealers in Pittsburg, and that they bought Neutral Topaz Oil of Dr. Tweddle during that period.

He says (p. 252, int. 16) that he first saw Neutral Topaz Oil in the fall of 1867; that it was shown him by Dr. Tweddle at the Eclipse Works, and that the doctor asked him its commercial value, what quantity could be sold, and to what use it could be applied (int. 22); that they probably talked an hour or two hours, and that he told him (int. 23) almost any quantity could be sold if prices were satisfactory; and that at or about that time he took samples for the purpose of mixing with fatty oils, to see the result, which was favorable. (Int. 24.)

He says his firm purchased some of this oil in the summer of 1868, but he does not know whether it had the paraffine in or not; and that his firm made purchases after that time. (Ints. 25 to 30.) He gives no description of the oil he saw in 1867, except by saying that it was the same, for all practical purposes, as the Neutral Topaz Oil on the market at the time he gave his deposition (June, 1871), and that the color, though it might have varied somewhat, is best described as topaz color. (Ints. 20 and 21.)

He says that when the doctor showed him the first sample, the warehouse near the railroad was incomplete.

On cross-examination, he says that what the doctor first showed him was in a bottle (cross-int. 8, p. 255); that he made no memorandum of what he saw, or of the conversation, or the time of it. He says (cross-ints. 10 to 14) that circumstances occurring at the

time keep the transaction fresh in his memory, and that there are memoranda of those circumstances made at or about the time, which consist of notes given by his uncle to his grandfather, though what such notes had to do with the conversation with Dr. Tweddle, he can't say, except that they brighten his recollection as to time.

But though he is positive about the conversation and its date, yet there is a good deal that he does not recollect.

He does not remember what the doctor called the oil when he showed him the first sample (cross-int. 15); don't remember what prices he thought would be satisfactory (cross-int. 16); don't remember the price he paid for the first oil he purchased in 1868 (cross-int. 17); don't remember the amount; is not positive under what name he purchased it, but presumes it was topaz (cross-ints. 17, 18), is not sure; don't remember when he made the next purchase (cross-int. 20); can't remember the date of any purchase; presumes he made other purchases in 1868, but is not positive; the first purchase may have been late in the year, or it might have been large enough to last through the year. (Cross-int. 21.)

He says that in 1869 the price varied from forty-five cents to fifty-five per gallon, if his memory serves him correctly, and that he can't tell what quantity he purchased in 1869 while with the firm of Dalzell & Sons, without the books; but that if the books were there, he could. (Cross-ints. 25 to 27.) Now, though he thus appeals to the books, they are not produced, nor is any other member of the firm of Dalzell & Sons called to confirm his statements. Their books would of course show what oils they purchased of Dr. Tweddle, and when the purchases were made, and the prices. But this testimony, which is not liable to the imperfections of the human memory, is not produced, even when it is within reach.

After the witness formed his new company, in August, 1869, they purchased, he thinks, a hundred barrels of Neutral Topaz Oil before Dr. Tweddle's refinery burnt down in June, 1871, and the price, he thinks, was fifty cents a gallon.

It may be safely assumed that if he paid from forty-five cents to fifty-five cents per gallon for the oil he purchased in 1869, he did

not purchase Neutral Topaz Oil; for Dr. Tweddle testifies (p. 206, cross-int. 133) that while he was manufacturing Neutral Topaz at the Eclipse Works, at Sharpsburg Bridge, the price was from seventy to eighty cents; and on p. 216 (cross ints. 227, 228) he states that the price of what he calls Neutral Topaz with the paraffine in, was, in 1869, from seventy to eighty cents.

We may justly conclude, therefore, that the oil he bought in 1868 and 1869, which he thinks was like what he saw in 1867, could not have been Neutral Topaz Oil, either with the paraffine expressed or with it in.

Another witness, C. Tiers Myers, of Philadelphia, testifies that in the summer of 1867 he was at the Eclipse Refinery, and that Dr. Tweddle showed him some light oil and some dark oil; that the light oil was yellow, a lightish yellow, about the color of sperm oil. He describes the oil and its uses as follows (p. 271): —

"*Int.* 20. To what purpose did you understand the light yellow oil to be adapted?

"*Ans* As a base oil, and for lubricating spindles in cotton and woollen factories, and general lubricating purposes. It was a suitable oil for mixing or compounding. It would enter into druggist's use, as he said, and expatiated on it at the time.

"*Int* 21. Did you take notice of the odor of the light-colored yellow oil you have just spoken of?

"*Ans.* Yes, sir. The doctor drew the cork from a sample vial when he showed it to me, and remarked, in general terms, that there was no particular flavor about it odorous; hence its adaptability for general purposes."

Now, all this would be true of the common paraffine oil, or of the amber oil the doctor made; of the latter particularly, which has very little odor, and is a light-colored oil. The witness' understanding of an odorless oil may be inferred from his statemnnt that the dark-green railroad oil is "seemingly odorless; in comparison with petroleum oil it is odorless; I mean it has much less odor than crude petroleum. I think it has."

Page 273, cross-int. 16.

But it does not appear that he knew anything about the odor from his own examination. He was asked, indeed (int. 21), if he took

notice of the odor of the light-colored yellow oil. And his reply just quoted indicates that he only observed the doctor's statement.

He has nothing but his unaided recollection to fix the date when the doctor showed him the oil, unless he means to refer to the state of the warehouse for that purpose, which he says was incomplete; but as he says that he was at the Eclipse Refinery several times, both in 1867 and '68 (cross-ints. 17, 19), there could have been nothing in the fact of the incompleteness of the building to enable him to fix upon the times of his visits or the conversations with the doctor.

But his answer to the twenty-fifth interrogatory seems to imply that when the doctor showed him the oil, or at least when he procured some not long after, the doctor called it Neutral Topaz Oil.

"*Int* 25. Are you acquainted with lubricating oil recently manufactured by Dr. Tweddle, and called by him "Neutral Topaz Oil"?

Ans. I knew of the oil that he showed me at that time, and called it neutral, or topaz oil, I think. I am not acquainted with the oil he now manufactures by that name."

If the doctor did call it Neutral Topaz he must have showed it to him much later than the witness supposes, for Dr. Tweddle says (p. 209, cross-int. 165) that he did not call it Neutral Topaz till the fall of 1868.

It is proper to observe that all the witnesses to corroborate Dr. Tweddle, whose testimony we have examined, with the exception, perhaps, of Robert Hill, speak entirely of independent facts; they do not corroborate each other, and even Dr. Tweddle does not name these men as men to whom he had shown or given his Neutral Topaz Oil.

But we now come to a witness to whom Dr. Tweddle says he gave a sample of the bucketful of his Neutral Topaz Oil, which he claims to have made in 1867. This is Mr. Loring C. Lombard, of New York, to whom the doctor applied in the fall of 1867 to aid him in getting up a company to carry on his refinery.

Dr. Tweddle says that in September, 1867, he visited New York, and carried to Mr. Lombard samples of his products, — burning oil, Neutral Topaz Oil, residuum, and refined paraffine.

Mr. Lombard says Tweddle did bring him a box containing samples, and he produces the box. But it contains samples only of residuum and burning oil and one empty bottle. It contains no Neutral Topaz or paraffine.

Mr. Lombard says the box had in it five bottles when it was brought to him; that one of them contained its present contents, a heavy, green lubricating oil, one an oil of straw color, and that three contained kerosene like that now in one of them.

Mr. Lombard thus describes the straw-colored oil, which he says was in one of the vials (p. 276): —

"*Int.* 23. What did you understand the one vial of straw-colored oil to be?

"*Ans.* At the time, I considered it a poor oil that would have to be bleached; but the doctor then told me that that was not for illuminating but was a lubricator, — what he called a spindle oil. What surprised me was its being perfectly deodorized, and yet of that dark color.

"*Int.* 24. State as nearly as you can describe it what color the oil was which the doctor called spindle oil.

"*Ans.* As near as my memory serves me it was a rather bright straw color."

This clearly does not identify the oil with Neutral Topaz, for the description is perfectly applicable to the doctor's amber oil, which he made in the summer of 1867; and it is remarkable that this witness, though in the oil business and therefore undoubtedly familiar with oils, was not asked about the green and blue tint of the sample of straw-colored oil, nor how that oil compared with the Neutral Topaz since produced by Dr. Tweddle.

No attempt is made to account for the loss of the missing bottles or the paraffine. The contents of the bottle which is now empty have apparently evaporated through the cork, as they appear to have gone off gradually, for two years before the witness testified, the bottle was not quite empty, but it had become empty since. It might have done this if the fluid were volatile like naphtha.

Mr. Lombard states, in answer to ints. 21, pp. 423, 434, that he discovered the loss of the two bottles about two years before,

and that bottle No. 3, "was then nearly empty, the contents having soaked out of the box, and that it has all gone since." Apparently the contents must have been of a volatile character to have disappeared in this manner.

The witness identified a prospectus for the proposed company, as having been shown him by Dr. Tweddle. This circular, Exhibit 77, is printed at p. 242, and speaks of benzole, illuminating oil and lubricating oil as the articles which would be produced by his new process, and which would make up the whole product of the petroleum distilled. This lubricating oil mentioned in the circular was the dark-green residuum oil, corresponding by its description in the circular, on p. 243, with the contents of bottle No. 1.

The circular makes no mention of spindle oil, the name Dr. Tweddle says he gave to his Neutral Topaz at that time.

Why should he have carried to Mr. Lombard a sample of an article not specified in his circular as an article which the new company was to manufacture?

And why should he not have given him a specimen of benzole which he was to manufacture? And is it not possible, and even probable, that the empty bottle, No. 3, which has lost its contents (a part within two years before the witness testified), apparently by evaporation, contained benzole, a liquid which might easily disappear in that way?

Mr. Lombard may have easily been mistaken about the contents of the box. He met with an accident soon after, which injured him so that he was not able to attend to business for about a year, and after that he went abroad and remained nine months.

At the time of his examination he had nearly forgotten the existence of the circular, and had entirely forgotten its contents. (Page 277, cross-ints. 1 to 5.) He could quite as easily have forgotten the contents of the bottles.

If there were five bottles, or perhaps more, as Mr. Lombard seems to think there may have been, two or more of which are missing, one

at least of the missing ones, according to Mr. Lombard's account, must have contained kerosene.

The testimony of another witness, brought forward to corroborate the testimony of Dr. Tweddle, remains to be considered.

It is that of Joseph Clark, who was in the employment of the doctor in 1867 and a part of 1868, and who was his foreman at the time he gave his deposition. He also was in the doctor's employment at the Standard Works, and his testimody about the Barren County oil has already been considered.

His testimony as to the production of Neutral Topaz by Dr. Tweddle, in 1867, is substantially all contained in the following extracts from pp. 280, 281, 282.

After some inquiries as to the cast-iron still first put up at the Eclipse Works, and the manner of using it, the products are inquired about as follows: —

"*Int.* 29. What was the first product or result of distillation?

"*Ans.* Benzole.

"*Int.* 30. What was the second product?

"*Ans.* Illuminating oil.

"*Int.* 31. About what was the gravity of the illuminating oil, or second product you have mentioned?

"*Ans.* The average gravity of it was about 45 or 46.

. . . . . .

"*Int.* 33. What was the next, or third product of the distillation?

"*Ans.* The third product of distillation was a heavy yellow oil.

"*Int.* 34. About what gravity was this third product?

"*Ans.* It was about 32°.

"*Int.* 35. Were these products kept separate, or were they all run into the same receiver?

"*Ans.* They were kept separate.

"*Int.* 36. Was the distillation carried on further or not?

"*Ans.* It was not.

"*Int.* 37. Was there any, and if any what residuum left in the still, after the third product was carried over?

"*Ans.* Yes, sir. It was a dark-green, heavy oil.

"*Int.* 38. What was the second product, I mean that which came after the benzole, called by Dr. Tweddle?

"*Ans.* Refined oil.

"*Int.* 39. What was the third product called by him?

"*Ans.* He called it the spindle or machinery oil.

"*Int.* 40. What was the residuum left in the still called by him?

"*Ans.* It was called the Eclipse Railroad Oil.

"*Int.* 44. During the time that you remained at the Eclipse Works, at Sharpsburg Bridge, did or did not this first apparatus continue to be used by Dr. Tweddle?

"*Ans.* It did continue to be used.

"*Int.* 42. In what way, — the same or a different way?

"*Ans.* It continued to be used in the same way.

"*Int.* 43. What was the character, appearance and odor of the residuum remaining in the still after the process of distillation which you have described? I refer to the first use of the apparatus you have mentioned at the Eclipse Works.

"*Ans.* It was a heavy lubricating oil, of a dark-green color, and from 28 to 30 gravity. It did not have very much odor.

"*Int.* 44. What was the character, appearance and odor of the third product, which you say was called spindle or machinery oil?

"*Ans.* It was a yellow oil of about 30 to 32 gravity. It did not have much odor.

"*Int.* 45. You have stated that after the first use of this apparatus at the Eclipse Works, it continued to be used, while you remained there, in the same way. State whether or not the same products which you have named as distillates and the residuum were produced in such subsequent use of the apparatus.

"*Ans.* Yes, sir; they were.

. . . . . .

"*Int.* 47. Are you acquainted with the oil now made and sold by Dr. Tweddle under the name of 'Neutral Topaz Oil'?

"*Ans.* Yes, sir.

"*Int.* 48. State how that Neutral Topaz Oil, now made by Dr. Tweddle, before the paraffine is expressed out of it, compares with the spindle or machinery oil, or third product of distillation, made by the apparatus at the Eclipse Works, in April or May, 1867.

"*Ans.* It is about the same oil; there is no difference in it.

"*Int.* 49. How does it compare in color and odor?

"*Ans.* Color and odor about the same.

"*Int* 50. Did this first production of machinery or spindle oil, made in April or May, 1867, have the paraffine pressed out of it at that time?

"*Ans.* It had not.

"*Int.* 51. Did you, at any time previous to your leaving the Eclipse Works, press out the paraffine from this spindle oil, or third distillant; and if so, when, where, and how?

"*Ans.* I pressed some out in September, 1867, in the machine shop attached to the works, in an iron drill press, where I got power to press it with.

"*Int.* 52. Did you ever use any of this spindle or machinery oil on any machinery; and if so, when and where?

"*Ans.* Yes, sir; I used some of it on our machinery at the works directly after pressing it at the time I spoke of in September, 1867.

. . . . . .

"*Int.* 60. You spoke of having pressed out the paraffine from some of this spindle or machinery oil in the drill press in September, 1867. State by whose instructions you did this.

"*Ans.* Dr. Tweddle's instructions.

"*Int.* 61. Between the time when you commenced making this third distillant or spindle oil in May, 1867, and September, 1867, had you accumulated any of this oil at the works; and if so, about what quantity?

"*Ans.* We accumulated upwards of one hundred barrels."

It may be admitted that this witness was in a position to know what was done at Dr. Tweddle's refinery in 1867, and that his testimony is explicit that the heavy oil distilled that year, and called spindle or machinery oil, was the same, or about the same, as the Neutral Topaz Oil before the paraffine was expressed, made at the time the witness testified; and that it is explicit that he did in that year, by the doctor's direction, press some of the oil in a drill press to remove the paraffine.

We may remark that this last statement is not in harmony with Dr. Tweddle's testimony on the same subject.

The doctor mentions (p. 230, ans. 201) as the only occasion on which paraffine was expressed from the oil in 1867, the treatment of about a bucketful of oil, and this he says was done *at his house* and with an impromptu *lever press.*

There is no intimation in his testimony that any oil was pressed at his works, either by himself or by his direction.

He also states explicitly that about one hundred barrels of this spindle oil were accumulated during the summer of 1867. On p. 290, cross-int. 95, he says this oil was probably about ten per cent of the crude oil used, thus making the whole amount of oil distilled about one thousand barrels, if the third product or spindle oil was always produced. This would be about ten days' work during the summer. Dr. Tweddle, as we have already seen, stated the amount of crude oil distilled that season at from 1,500 to 2,500 barrels.

We do not stop to analyze the testimony of this witness, for we think the Court will be satisfied that he is entitled to no credit.

Dr. Tweddle testified on his cross-examination that this witness, Joseph Clark, and one Joseph Freeman, worked for him in carrying

on his business of distilling in 1867, and that Freeman was, at the time he testified, his foreman and the manager of his works at Aladdin.

Page 195, cross-ints. 22 to 24; and p. 201, cross-ints. 87, 88.

Joseph Clark left his employment in September, 1868, and was in 1871 till June at work for Lockhart, Frew & Co., at the Brilliant Oil Works. He left them and returned to Dr. Tweddle's employment July 4, 1871, a few months before he gave his deposition.

Page 280, int. 24, and p. 285, cross-ints. 12 to 15.

Joseph Freeman, who assisted in the distillery operations in 1867, when it is claimed that Dr Tweddle made a hundred barrels of spindle oil like his Neutral Topaz before the paraffine is extracted, has not been called as witness. Joseph Clark is called. Is it conceivable that Freeman would not have been called if he could confirm the testimony of Clark and Dr. Tweddle?

The complainants have produced a witness who swears that Clark on one occasion deliberately stated that Dr. Tweddle never made such oil as his Neutral Topaz until 1869, and the neglect to call Freeman can be from no other cause than that he would confirm Clark's first statement and not his last.

We have already stated that the complainants had no notice of the claim of Dr. Tweddle to be the first inventor until it was brought out at the examination of Dr. Tweddle at Pittsburg, about the last of February, 1871. The examination was suspended on the 3d of March, and on the 6th of March, Mr. Abbott, one of complainant's counsel, sought an interview with Mr. Clark, to obtain information about the claim of Dr. Tweddle to be the first inventor.

This interview took place at a hotel in Pittsburg. Mr. Abbott's account of the interview is found on pp. 343, 344, and is as follows: —

"*Int.* 27. If in the prosecution of your inquiries upon this point you had an interview with one Joseph Clark, will you state when you first saw him, and what then passed between you?

"*Ans.* I saw Joseph Clark first, on the 6th of March, 1871, at the 'Brilliant Works,' above Sharpsburg. I asked him his name, and if he was the Joseph Clark who had formerly worked for Dr. Tweddle, and if he was still in his employment. He said that he formerly worked for Dr. Tweddle, and that he was not working for him then. I asked him if he was willing to go down to Pittsburg and have a talk with me in regard to Dr. Tweddle's works. He said he had no objections. I told him I had been into the doctor's works some time previous, that I had a rude plan of them and wanted to know if he could give me any additional information, and I would pay him for his time. I made a definite bargain with him for the day, and we took the train for Pittsburg and took a room at the Union Depot Hotel.

. . . . . .

"*Int.* 30. State generally what was the subject of conversation while in the room together.

"*Ans.* It was in regard to Dr. Tweddle's lubricating oils.

"*Int* 31. State whether or not you made any memoranda in Clark's presence of what he then said, and whether you have those memoranda now.

"*Ans.* I made a few memoranda at that time in the room, which I have here.

"*Int.* 32. Will you read those memoranda.

"*Ans.* I read from pages 20 to 24, inclusive, of a memorandum book which I kept at the time. 'Wilkins and Brereton, 4 years standard, 3 foreman, went with T to Eclipse, and staked it out, snow on ground in January, '67. Still cast at Totten's foundry at Pittsburg. Clark fitted it up in general, he being then in general charge. About May, when done. Oil was run in by vacuum — constant. Only now and then still being filled, would have to stop running in, and draw off from the bottom the lubricating oil, dark green; had a smell, but not so strong as when it went into the still. Joseph Clark, 94 Federal Street, Alleghany city; Saturday night to Monday morning, at his father's; wife and five children; North Fayette Post Office, Alleghany County, 10 miles from Pittsburg on Pan Handle Railroad; gets off at Gregg's Station, which is nearest to his house, and that is one and a half miles; 2 cast-iron boxes in the still just alike; right and left partition in each box; 2-inch pipe runs from the outer case of the boxes; 3-4-inch pipe from the inner case of the boxes through the 2 inch pipe, and the steam went in through the 3-4-inch and back between the two pipes, the 2-inch being plugged up at the outer end, then the oil was run in to drop on to these hot pipes. John Gracie's, — *first nice lub. oil about 18 months since, inside of that never got up anything near like the samples in the little still, or before I went to Aladdin.* He agreed to have me go for 9 months, and no longer. *T. was trying for nicer lub. but never got anything free from smell, or light color.*'

"*Int.* 33. Will you explain what you mean by 'Wilkins and Brereton' in the above memoranda?

"*Ans.* Those are names Clark gave me as persons being connected with refinery at Aladdin, where he was sent by Dr. Tweddle as temporary superintendent.

"*Int.* 34. What is to be understood by "T." as used with memoranda?

"*Ans.* "T.," whenever it occurs in these memoranda, means Dr. Tweddle.

"*Int* 35. What is the meaning of "lub." when it occurs?

"*Ans.* Lubricating oil from petroleum.

"*Int.* 36. What samples were those which are mentioned in the memoranda?

"*Ans.* They were two samples of petroleum lubricating oil which I had called Clark's attention to, and which he had examined.

"*Int.* 37. What oils were they?

"*Ans.* One of them was Mr. Merrill's manufacture and the other Dr. Tweddle's.

"*Int.* 38. Do you know the names that were affixed to them? If so, give them.

"*Ans.* I think Mr. Merrill called his 'Spindle Oil.' The other oil I obtained from a party who said it was Dr. Tweddle's Neutral Topaz Oil.

"*Int.* 39. Have you those samples now in your possession? If so, can you produce them to be marked as Exhibits?

"*Ans.* I have them, and produce them to be marked 'Plaintiff's Exhibits Nos. 96 and 97.'

"*Int.* 40. State which of these is Merrill oil and which one said to be Neutral Topaz Oil.

"*Ans.* I havn't kept them distinguished in my mind from that time to this. I am not sure that the labels on them correspond to the oils. I only know that those are the two oils that I showed to Mr Clark.

"*Int.* 41. How much did Clark examine them?

"*Ans.* He examined them very particularly indeed. I made a special point of securing his careful examination of them. He smelt of them very carefully indeed, stepped to the window with them, looked through them, felt of the oils. I watched him very particularly while he was making the examination and was entirely silent myself.

"*Int.* 42 Will you state whether or not your memoranda contains all that he said about those samples, or about the manufacture of such oils by Dr Tweddle; or whether or not in substance he repeated his statements, as contained in your memoranda, more than once?

"*Ans.* The memoranda does not contain all that he said. He was free to explain to me all that he knew, and said a good many things that I did not get down. *He was very positive in regard to the fact that, to his knowledge, no oil had been made by Dr. Tweddle of that nature, prior to his going to Aladdin.* I did not inform him the reason why I wished to know. I was especially careful not to assist him in fixing the time. I was seeking his knowledge, free from any influence of my own. He went back and made a second examination of these oils, and shook his head and said, 'NOTHING LIKE THEM WAS MADE'"

It will be observed that Mr. Abbott's statements are based upon a memorandum made at the time, and his memory is therefore likely to be correct. Moreover, he was making an investigation in behalf of his client, the necessity for which the law recognizes, and it would be his duty to be careful in his inquiries, and report the results he obtained correctly to the counsel who had the general management of the case.

The memorandum on its face bears a statement which shows that the witness must have denied that Dr. Tweddle, before Clark

went to Aladdin in September, 1867, ever made an oil like the samples produced, which have been made exhibits in the case, marked 96 and 97.

The samples show that they are Neutral Topaz, or deodorized oil. Clark was interrogated, on cross-examination, as to this interview, and his account is found on p. 292 to 297. He denies that he said that Dr. Tweddle ever made any oil like the samples until about eighteen months before that time, and several other statements asserted by Mr. Abbott, and the Court must decide as to which party is to be believed. But there are several important circumstances to be considered in deciding what reliance should be placed on Clark's account. It appears from his own statement that the conversation was broken off by a call for him from Mr. John Gracie, a member of the firm of Lockhart, Frew & Co., in whose employment Clark then was; that he left the room, to see Mr. Gracie, saying, as he says (p. 292, cross-int. 121), that "he might possibly be back soon"; but, as Mr. Abbott says (p. 346, int. 45), that "he would be right back." But he did not go back, and he says that the reason was that "Mr. Gracie told me when I went down stairs that I should not have left the works without his knowledge, and that I ought not to be talking to men whom I knew nothing of." He says he told Mr. Gracie what he came there to talk about. (P. 292, cross-ints. 123, 124.)

Now, if we turn to the cross-examination of Dr. Tweddle, on p. 193 to 196, we shall find that he was there with Mr. Gracie, and there can be no other conclusion from what he says and from what he refuses to say than that he was there to get Mr. Clark away from Mr. Abbott. His whole account is as follows: —

"*Cross-Int.* 12. Are you acquainted with a man in this city by the name John Gracie, who is in some way, I believe, connected with the firm of Lockhart, Frew & Co.?

"*Ans.* I am.

"*Cross-Int.* 13. Do you remember going with Mr. Gracie, two or three days after the adjournment of the taking of this testimony in March last, to the Union Depot Hotel in this city?

"*Ans.* I met Mr. Gracie in the Union Depot Hotel in this city — I did not go to the hotel with him — one day in March last.

Cross-Int. 14. Where there not one or two other men in company with you at the same time?

"*Ans.* I suppose I saw a dozen people there I knew. There were two gentlemen in company with me at the time.

"*Cross-Int.* 15. Who were they?

"*Ans.* One of them, I think, was Mr. Schmidt; the other one was Mr. Harper.

"*Cross-Int.* 16. Will you give the full names?

"*Ans.* I don't know their full names. Mr. Schmidt's name is Edward. I don't know Mr. Harper's.

"*Cross-Int.* 17. What was the object of your visit there?

"*Ans.* My own particular object?

"*Cross-Int.* 18. Your object, and that of those gentlemen who were there in your company. I mean were you there for any object in common with the other gentlemen? If so, what was it?

"[*The counsel for the defendants object to inquiry as to the 'object,' understanding by that 'purpose," and submit that the question should be addressed to what was said or done at the interview referred to.*"]

"*Ans.* I don't think that my private business is the subject of investigation to any one.

"*Cross-Int* 19. Do you decline to make any further answer?

"*Ans.* I decline.

"*Cross-Int* 20. Can you tell about how long it was after the adjournment in taking your deposition (which was the third of March) when this visit to the hotel was made?

"*Ans.* I really forget.

"*Cross-Int.* 21. It was within a few days, was it not?

"*Ans.* It was.

"*Cross-Int.* 22. Do you know a Mr. Joseph Clark, who is or has been in the employment of the Brilliant Oil Works, in or near this city?

"*Ans.* Yes.

"*Cross-Int.* 23. He was formerly in your employment, was he not?

"*Ans.* For a good many years.

"*Cross-Int.* 24. During what time?

"*Ans.* From 1862, I think, to about 1870.

"*Cross-Int.* 25. Did you not go to the Union Depot Hotel, in March last, at the time referred to, for the purpose of seeing Mr. Clark?

"*Ans.* That is my own business.

"*Cross-Int* 26. Did you not, or the gentlemen with you, make an effort to see him at that time?

"*Ans.* I believe they did.

"*Cross-Int.* 27. Did you not inquire there of a waiter by the name of Miller, but who, I believe, is called Luther, as to whether Mr. Clark was in the house, and did you not send to two or three rooms for the purpose of finding him? I refer now to yourself, personally.

"*Ans.* I did not ask any waiter for Mr. Clark. I sent a waiter to find who were in certain rooms in the hotel.

"*Cross-Int.* 28. Was not Mr. Clark one of the men you wished to find?

"*Ans.* That is my business.

"*Cross-Int.* 29. Do you decline to give any other answer?

"*Ans.* Yes, I decline.

"*Cross-Int.* 30. Did not you or Mr. Gracie send up a card, with Mr. Gracie's name on it, to a room where you supposed Mr. Clark was?

"*Ans.* I sent up no card. I don't know anything about what Mr. Gracie did.

"*Cross-Int* 31. Don't you know that a card was sent up to Mr. Clark?

"*Ans.* I don't.

"*Cross-Int.* 32. Did Mr. Clark come down?

"*Ans.* I really know nothing about it. I saw Mr. Gracie for a moment at the hotel. I left and came down town.

"*Cross-Int.* 33. Did not you tell a waiter at the hotel, after you had sent to two or three rooms to find out who were there, 'It's all right; Mr. Clark's coming down,' or something to that effect?

"*Ans.* I did not say any such thing.

"*Cross-Int.* 34. Did you not know before you left that Mr. Clark was coming down, and did you not purposely step to one side to avoid meeting him?

"*Ans.* I did not know whether Mr. Clark was up or down, or where he was; I did not step on one side to avoid him or anyone else.

"*Cross-Int* 35. In your answer to the 27th cross-interrogatory, you say you sent a waiter to find who were in certain rooms in the hotel: whom did you desire or expect to find?

"*Ans.* Really, I don't know who the persons were.

"*Cross-Int.* 36 Was not Mr. Clark one of them?

"*Ans.* That is my business.

"*Cross-Int.* 37. Will you answer directly whether or not Mr. Clark was one of them?

"*Ans.* I decline.

"*Cross Int.* 38. Mr. Clark did go down, on receiving Mr. Gracie's card, and promising to return immediately, — but he did not. In the afternoon of the same day he met the gentleman again, who was in the room with him, and said that he declined to give any further information as to the manufacture of your Neutral Topaz Oil, because you were influential and would procure his discharge from the place where he was employed. Had you said or done anything to justify him in making that statement, or do you know whether Mr. Gracie or anyone had said or done anything of that nature?

"*Ans.* I never said to Mr. Clark that I would get him discharged from any place. What other people said I know nothing about.

"*Cross-Int.* 39. Are you willing that Mr. Clark should communicate any facts that he may know relative to your manufacture of Neutral Topaz Oil, or of other oils that you manufacture?

[*The counsel for the defendants instruct the witness that this is not a question proper to be put or that he is required to answer, because he is here to give testimony and not promises.*]

"*Ans.* I decline to answer."

Now, we submit that it is perfectly clear from the testimony that Dr. Tweddle was concerned in getting Clark away from the complainant's counsel, and there could be but one reason for that, — the fear that Clark's communication would be prejudicial to his interests in this suit. Why should he decline to tell what his object was in going to the hotel, or to give any reason for his refusal except that he "don't think his private business is the subject of investigation to any one"?

He is informed that Mr. Clark, on the same day, had declined to give any further information on the ground that Dr. Tweddle might get him discharged from his place, and he is asked if he was willing Clark should communicate any facts he may know relative to the doctor's manufacture of Neutral Topaz, etc. (p. 196, cross-ints. 38, 39), and he declines to answer. Could he have had any objection to answering if he had been willing that Clark should tell?

Now, this cross-examination of Dr. Tweddle took place on the 10th of June, and it disclosed pretty clearly the fact that the complainant's counsel were anxious to confer with Clark, and on the 4th of July following, Clark goes into Dr. Tweddle's employment and is in his employment when he is brought forward as a witness.

Clark, according to his own account, was conscious at the time that what he was telling must be prejudicial to Dr. Tweddle, for he says that he told Mr. Abbott "he had no right to give him such information as he wanted." Why not, if that information was that Dr. Tweddle made Neutral Topaz in 1867? But he goes on to say, Mr. Abbott then "told me that if anything should result from my giving such information in regard to losing my situation, or getting any ill will from parties, that they had talked that over, and would provide him with a good situation, etc." This, he says, was while they were in the room. Assuming this to be true, which we in fact deny, does it not clearly show that the information was of a character very different from that contained in his direct examination?

We submit that the circumstances fully show that Dr. Tweddle had some pressing reason for preventing Clark from communicating information to complainant's counsel, and that a strong presumption

arises that the information he had communicated, or could communicate, was such as Mr. Abbott says he did communicate. If the facts are as Clark says, how could it harm Dr. Tweddle to have them known? And if the facts are as Clark has testified, why is it that Freeman, his foreman in making the oil, if it was made, does not come forward to support Clark?

We have now considered the testimony of all the witnesses who have testified in relation to oil made or exhibited by Dr. Tweddle in 1867. Only two of them, Clark and Kelley, profess to know anything of the distillation of oil at Dr. Tweddle's refinery in 1867. Clark has, as the complainants claim, made statements in direct conflict with his testimony, and the circumstances connected with his communication to complainant's counsel expose him to grave suspicion.

Kelley does not state how much he saw of the operations at the refinery; but he makes mistakes of such importance that his recollections are certainly not entitled to confidence.

Going outside of the doctor's refinery, one man, Douglass, is produced as having used a heavy lubricating oil made in 1867 by Dr. Tweddle, like the Neutral Topaz Oil before the paraffine is removed, though the doctor does not say so, and the only direct testimony to the fact is from the witness Clark. But it is clear, from a certificate which the witness gave to Dr. Tweddle as to the merits of the oil he used previous to that time, that the oil must have been the residuum oil, and not the Neutral Topaz Oil with the paraffine in.

Three witnesses are brought forward as having seen small samples of the Neutral Topaz Oil in 1867, viz., Howard, Myers and Lombard. Neither Mr. Lombard nor Mr. Myers testifies that the specimen they saw was the same with the Neutral Topaz sold by Dr. Tweddle at the time this evidence was given.

Mr. Howard alone testifies that the sample he saw was like the Neutral Topaz he afterward bought, excepting that he does not know

whether or not the paraffine had been removed. Not one of these witnesses, except Mr. Lombard, has any means for fixing the dates of which he speaks with any degree of certainty.

And as to the fact of the actual production of an oil like Neutral Topaz by the removal of the paraffine, not one witness except Clark furnishes the slightest corroboration to Dr. Tweddle. All the evidence that he actually made an oil like Neutral Topaz before Merrill's invention rests upon his testimony and Clark's.

Taking into consideration the fact that, from the doctor's own testimony, the character of the oils which he made in 1867 must have been known to a large number of persons in Pittsburg interested in the manufacture of oil, not one of whom has been called to testify on the subject; and calling to mind also the manner in which the doctor influenced Clark's testimony, as already pointed out, and his persistent attempts to induce the witness Colgate to antedate his testimony, and, on his refusal to do so, the manner in which the doctor obtained possession of and withheld Colgate's letters and memoranda on the subject, which we shall refer to more in detail hereafter (see Record, p. 408), we submit that we are justified in the belief that the defendants have called on this point only such witnesses as were either directly under Tweddle's control or could be persuaded by him into the belief that they had seen his Neutral Topaz Oil long before they had really done so.

We claim that this evidence is too uncertain and indefinite, and too much dependent upon the unsupported recollection of witnesses, to establish the fact that he made either finished Neutral Topaz or the distillate from which it is produced, or to justify the Court in setting aside a patent granted to one who is clearly an original inventor, and who was certainly the first to bring the invention before the public.

Complainants' rebutting Evidence.

Against this testimony, resting entirely on the memory of a few witnesses speaking four years after the time of which they profess to speak, the complainants have brought forward a history of things done by Dr. Tweddle which are wholly inconsistent with the claim he now makes that he produced the oil in dispute in 1867.

Obviously, if Dr. Tweddle, from and after September, 1867, had pursued a course of action which necessarily implied a knowledge of the invention, this evidence would have been appealed to as the highest class of corroborating testimony; and just as obviously a course of action inconsistent with what might be expected from a man in possession of such knowledge would furnish the strongest evidence that he did not possess it.

Dr. Tweddle did, in fact, appeal to this class of testimony when he asserted that, in the fall of 1867, he took measures to form a company to manufacture, as he says, this kind of oil and others, and to that end applied to Mr. Lombard, of New York, for assistance, and furnished him with a sample of the oil.

We quote the questions and answers in full, by which this claim is made that he did take steps looking to the manufacture of this oil in the fall of 1867: —

"*Int.* 137. After making the Neutral Topaz Oil, between June and September, 1867, at the Eclipse Works, did you or not make any effort to interest any other party with you, or to get up a company to manufacture *that and your other oils?* If so, state when, and with what result.

"*Ans.* In September, 1867, I tried to organize a company to assist me in enlarging and carrying on the refining operations at my works. I went to New York in the latter part of September, 1867, with that object in view. I had previously had several communications with Mr. L. L. Lombard, of New York, on the subject. I was very much embarrassed financially at the time, my works having cost me a great deal more than I had anticipated. Mr. L. L. Lombard commenced to try and enlist some of his friends in the enterprise. His prospects of success were such that I came back to Pittsburg, about the 20th of September, 1867, and went to Cleveland. My house near the Standard Works was burned during my absence in Cleveland. I returned to Pittsburg, and in October, the early part I think, I ordered the two vacuum pans or stills, etc., Exhibit No. 35, and other apparatus. I devoted my entire attention to the enlargement of my works during that fall and

winter. In the latter part of December, Mr. Lombard was nearly killed in the Angola disaster, near Buffalo, and the embryo organization of the company fell through.

"*Int.* 138. State whether, in that connection, you exhibited any samples or specimens of the products of your works to Mr. Lombard, — when and what they were.

"*Ans.* About September, the 16th or 17th, 1867, I went to New York with my family, and took with me samples of my products, — burning oil, *neutral topaz oil*, residuum and refined paraffine. I gave them to Mr. Lombard, and returned to Pittsburg on the 20th or 21st of the same month. I went to Cleveland on 23d of September."

Page 173.

On p. 164, int. 78, the doctor asserts unequivocally that he purposed, when he put his first still in operation in May or June, to manufacture burning oils, lubricating oils and paraffine; in the testimony just quoted (ints. 137, 138), he asserts just as unequivocally that in the fall of 1867 he took steps to form a company to manufacture *Neutral Topaz Oil* with his other oils.

On cross-examination (p. 206), he says that these efforts to form a company were made in Pittsburg as well as in New York, and he thus describes these efforts: —

"*Cross-Int.* 136. What were those efforts?

"*Ans.* Simply talking, generally, to the different parties whom I knew, about my intentions.

"*Cross-Int.* 137. Can you mention the parties you talked to?

"*Ans.* I talked to a great many parties, — Messrs. Lockhart and Frew, Mr. Kier, Mr. Myers (C. T.), of Philadelphia, and others; I forget whom."

Now, not one of the Pittsburg parties here named has been brought forward to testify to what the doctor told them about his intentions.

In his appeal to contemporaneous or subsequent acts, he wholly fails to appeal to these men.

But the complainant pushed his inquiries as follows: —

"*Cross-Int.* 138. Did you publish in the papers, or cause to be published, any account of your improvements?

"*Ans.* *I really forget whether I did or not.*

"*Cross-Int.* 139. Will you reflect a moment, and see if you can recollect whether you published or caused to be published in the 'Pittsburg Commercial' any articles during the months of August or September, 1867?

"*Ans.* *I really forget whether I did or not.*

"*Cross-Int.* 140. Will you look at the printed slip marked 'Exhibit No. 71, I. H. B.,' which I now show to you, and after reading it will you state whether this slip recalls anything to your recollection as to the publication of articles in that paper?

"*Ans.* I presume that that was written by some of the reporters who used to visit my works. *I do not remember anything further about it at present.*

"*Cross-Int.* 141. What is your recollection as to its having been written and published at your request and at your expense?

"*Ans.* *I do not think it ever was published at my expense.* I may have suggested the publication.

"*Cross-Int.* 142. Do you know what reporter prepared it?

"*Ans.* I do not.

"*Cross-Int.* 143. Are you sure that you did not pay the reporter for its preparation, and pay the paper for its insertion?

"*Ans.* *I am sure I do not know.*

"*Cross Int.* 144. Can you ascertain either or both of those facts?

"*Ans.* I cannot, except the proprietors of the newspaper choose to give the information.

"*Cross-Int.* 145. Will you make inquiries of the proprietors and ascertain the fact, if they are willing to give it?

"*Ans.* I will."

Pages 206, 207.

At a later stage of the cross-examination, Dr. Tweddle made some further statements in respect to this and some other similar articles published in the "Pittsburg Commercial" (p. 227).

"*Cross-Int.* 340. Have you ascertained whether the articles from the 'Pittsburg Commercial,' to which your attention was directed at an earlier stage of the cross-examination, were published at the dates on the slip, and whether you paid for their insertion?

"*Ans.* I have not yet, not having been afforded an opportunity to do so. I will do so. I never paid one cent in my life to have any articles published in a newspaper flattering either myself, or giving flattering descriptions of my works or my process. I have always paid for my advertisements, but never for any other article that I remember.

"*Cross-Int.* 341. Do your last observations as to what you have never done apply to the articles in question?

"*Ans.* They do, to the best of my recollection and belief.

"*Cross-Int* 342. I must request you to make inquiries at the office of the paper in question, and ascertain, before our next meeting, whether you did pay for the insertion of those articles or not, and what were the dates of those insertions.

"*Ans.* I will do so, and try to obtain duplicate bills of the advertisements in question."

But later still he was compelled to admit that he did pay for the publication of this and other articles, as follows (p. 235) :

"*Cross-Int.* 365. Have you ascertained the particulars inquired of in respect to the articles purporting to be copied from the 'Pittsburg Commercial,' to which your attention had been previously directed?

"*Ans.* I have, and find that I was charged in 1867 with several local articles besides advertisements. I never was aware, until this morning, that ever I had paid a cent for a local article. I presume the dates on the exhibits are the correct dates of publication."

Now, if the doctor had really forgotten that he procured these articles to be published as a part of his efforts to form a company, there can be no more striking illustration of the danger of relying on the mere recollection of witnesses.

If Dr. Tweddle could be mistaken as to facts of this kind, how much more easily could he, and the witnesses he has produced, be mistaken as to characteristics of samples of oil, or the time of a conversation, or as to the dates of such exhibitions or conversations.

The article to which the witness's attention was first directed is found on p. 235, marked "Exhibit 71." In printing the record, the date of publication was omitted ; but it appears on the original exhibit as Aug. 3, 1867, and in the last extract from the testimony, Dr. Tweddle admitted that to be the correct date.

In this article, which the doctor says may have been prepared at his suggestion, and which was not likely to be prepared at the suggestion of any one else, and for the publication of which he paid, we find the advantages of his inventions set forth most elaborately, not to say ostentatiously, and in a manner which leaves on the mind the conviction that nothing was left unsaid about it which could be said. After setting forth the difficulties and evils of the old processes, it announces the new invention to the public in the following terms : —

"It has remained for our well-known fellow-citizen, Dr. Herbert W. C. Tweddle, a gentleman learned in the sciences, and who has erected a number of the largest

and most successful oil refineries in operation, to develop a system which presents numerous advantages over the present method of making *illuminating oils*, and which, we are convinced, will effect a total and radical change in this branch of industry, superseding all other processes."

After an elaborate description of the apparatus and property at Sharpsburg Bridge, where Dr. Tweddle was putting his invention into practice, and a statement that he proposed to form a company, under the title of Eclipse Petroleum Refining Company, with a capital of half a million of dollars, for *manufacturing illuminating oils, etc.*, the advantages of the new process are given as follows: —

"Some of the more important of the advantages attending the use of Dr. Tweddle's process of manufacturing petroleum may be briefly stated as follows: —

"*First.* The use of fire is entirely dispensed with except under the steam boilers, which are situated some distance from the apparatus.

"*Second.* Danger from fire is entirely avoided, steam being the only agent used, and it is utterly impossible to ignite oils during the operation; consequently, insurance will be reduced to a minimum, and, except for warehouse and stock, is unnecessary.

"*Third.* The use of acids or chemicals to purify the oil is dispensed with, as it can be made better, purer, and superior in every respect without them, *whilst the percentage is increased.* The fire test of the oil can be made always from 125 deg. to 130 deg. Fahr., making it *a perfectly safe illuminator.*

"*Fourth.* *Refined oil* can be produced at one dollar per barrel less than by the present process in use.

"*Fifth.* In the present section of apparatus a period of from six to eight minutes elapses from the time the crude petroleum leaves the store tank until it is returned to the *refined oil tank finished oil.*

"*Sixth.* The whole apparatus is under the control of one operator; there are no laborious details to attend to, the opening and closing of a few valves constituting his entire work. There is no charging of stills, putting on or taking off manheads; no cleaning out of tar or coke; no bad odors or dirt, or destruction of apparatus. It works almost automatically, and transforms a disagreeable occupation into a pleasant one.

"*Seventh.* The apparatus can be put in operation in a few minutes, and can be run continuously. It can be stopped instantly, so that it involves no necessity to work on the Sabbath.

"The great and long-recognized desiderata secured by the introduction of this process can at once be appreciated by the public, especially by Pittsburgers who are familiar with the numerous conflagrations in refineries during the past six years. So disastrous have they been that many insurance companies refuse to take risks, and the few that do so obtain their own terms and the highest premium."

Page 364.

So minutely and elaborately are the advantages of the new process and its results set forth, that not even is the circumstance omitted that the process does not involve the breaking of the Sabbath, and yet there is *not a word about an improved lubricating oil.* Apparently, the manufacture of nothing but illuminating oil is contemplated, for nothing else is referred to. Not only is nothing else referred to, but in the third paragraph it is claimed not only that the oil is better, purer, and superior in every respect, but that a larger percentage is obtained; and this shows that the cracking of the oils must have been contemplated, for only by cracking or decomposing the heavy oils could more illuminating oils be obtained.

In his patent of 1870, for producing Neutral Topaz, Dr. Tweddle states (p. 445) that prior to his invention there described, "the efforts of oil manufacturers were chiefly directed to securing from the crude oil the *largest percentage of illuminating oil.*" And he goes on to explain that this was effected by so conducting the distilling operation as to decompose the heavier oils into lighter oils. His new process, he says (p. 446) is directly the "*reverse of this,*" *and* "*prevents such decomposition as far as possible.*" But in this article, published Aug. 3, 1867, and evidently for the purpose of promoting the formation of a proposed company, he sets forth as one of the merits of his invention, not that it is the reverse of the old process and does not decompose the oil, but that *it gives a higher percentage of the illuminating oil,* which is the result of the decomposition.

But this is not all. By the invention which he was then bringing to the notice of the public, he claims that he makes a better, purer and superior oil, having a fire test from 125° to 130°, which is a perfectly safe illuminator, and that he can make it a dollar a barrel cheaper than by the old processes. Now, in his patent of 1870, for making Neutral Topaz, he does not say a word about producing a better illuminating oil. Two descriptions could not more clearly apply to two different inventions.

Dr. Tweddle did not rest with one publication of the merits

of his invention. A few days later (Aug. 17), another article appeared in the same paper, written, he says, he presumes by some reporter, at his suggestion (p. 207, Cross-int. 146), calling attention to the prospectus of the Eclipse Petroleum Refining Company, in the same paper in which the doctor's new process is most emphatically set forth as relating to illuminating oils, and in which there is no allusion to improved lubricating oils, though the writer brings forward another advantage of the new process not mentioned in the previous article, to wit, the purification of the Alleghany River. We quote one passage from this article, which is found on p. 237 of the record: —

"Dr. Tweddle has given more patient study and diligent investigation into this important branch of business than perhaps any other gentleman connected with it, and the result is not only seen in the creation of a trade which owes its wide diffusion largely to the improvements he has introduced from time to time, not merely in the erection of those immense refineries which he has planned and constructed, but also in the discovery of a new process of manufacturing illuminating oils, which we do not hazard in saying will completely revolutionize the petroleum oil refining business, for the reason that it possesses so many advantages over every other known process that the natural result of its introduction and practical demonstration and successful operation must make it at once the most desirable, both for the manufacturer and consumer."

The prospectus referred to in the last article is printed on p. 238. It commences with the statement that "This company is to be organized to manufacture *Petroleum Illuminating Oil*, under patents granted to Dr. Herbert W. C. Tweddle."

In his testimony, he describes, on p. 164, ints. 75, 76, the still which he first put up at Sharpsburg, and which is the one he had in use at the time this prospectus was issued; and he then testifies as follows: —

"*Int.* 77. State whether or not you put this apparatus in operation at the Eclipse Works.

"*Ans.* I put it in operation about the latter end of May, or early in June, 1867.

"*Int.* 78. What did you purpose manufacturing at these works?

"*Ans.* Burning oils, lubricating oils and paraffine."

He *now* says he *then* purposed manufacturing "burning oils, *lubricating oils* and paraffine:" he *then* said the company was to be organized to manufacture "*illuminating oil*."

After a description of the property at Sharpsburg, the prospectus proceeds as follows: —

"The works when completed are designed to refine one thousand barrels of oil per diem.

"The following are a few of the advantages resulting from Dr. Tweddle's new process: —

"The business is entirely divested all of its present dangerous and hazardous character. No fire is used, save beneath the boilers, steam being the only agent employed.

"The use of acids and alkalies are entirely dispensed with, and the oil produced is made better and purer without them.

"Besides, the fire test is made higher by this process, and the oil *a safer illuminator*, and almost odorless.

"The whole apparatus is under the control of one operator, whether one hundred or one thousand barrels of oil per day are manufactured. The duty of this operator consists in the opening and closing of a few valves.

"There is no tar or coke to be cleaned out, and the apparatus can be started and stopped in a few seconds, thereby entirely doing away with the necessity of working on the Sabbath day.

"There is no bad odor generated in the manufacture of oil by this process, and no destruction to the apparatus. *The waste gases are utilized as fuel, and the residuum converted into lubricating oil equal in all respects to that from West Virginia and Ohio.*"

Page 238.

Here we find the first allusion to lubricating oil; but it is not to a paraffine distillate like Neutral Topaz, but to a residuum which was "equal in all respects to that from West Virginia and Ohio." In other words, to a dark-green, heavy, natural petroleum. No one ever thought of comparing Neutral Topaz with the natural oils of West Virginia and Ohio.

At the end of the prospectus it is stated that "*specimens of the products* can be examined and compared with those by the old process at S. M. Kier & Co.'s office." Mr. Kier has not been called to state that among these products was an oil like Neutral Topaz.

The next we hear of Dr. Tweddle through the papers is an account of an exhibition of the working of his still on the ninth day of September, 1867. A preliminary account of this exhibition is

given in Exhibit No. 74, p. 240. We quote one passage at the beginning: —

"HIGHLY SUCCESSFUL TEST OF DR H. W. C. TWEDDLE'S NEW PROCESS OF MANUFACTURING ILLUMINATING OIL.

"Dr Herbert W. C Tweddle's new process of manufacturing *illuminating oils* from petroleum, without the use of chemicals or alkalies, and solely by the adaptation of steam, was thoroughly tested yesterday afternoon at Dr Tweddle's new 'Eclipse Oil Works,' at Sharpsburg Bridge, and in the presence of a number of gentlemen who are engaged in the business of refining oil The section of the apparatus now completed was put into operation at two o'clock, when the crude oil from the store tank was turned on, and in precisely four minutes it began running into the receiving tank, pure, refined, white, non-explosive *illuminating* oil, and at the expiration of just seven minutes the refined oil flowed copiously into the tank."

The next day a certificate was published by a number of gentlemen calling themselves a committee organized to report on the efficacy and practicability of Dr. H. W. C. Tweddle's process of refining petroleum. This certificate, on p. 240, is marked "Exhibit No. 75." It states that fifty barrels of oil were refined in five hours, giving seventy-four per cent, or 1,416 gallons of refined or illuminating oil, and twenty-two per cent, or 430 gallons of lubricating oil. That this lubricating oil was not Neutral Topaz, but the dark-green residuum frequently spoken of, is apparent from the fact that a residuum is a necessary product; and as this lubricating oil with the illuminating oil makes up nearly the amount of the crude oil, it is evident that it must be a residuum oil. It also fully appears from a description of the products of his apparatus on p. 243.

One other document emanating from the doctor's pen, or inspired by him, remains to be considered. It is a prospectus, printed in a pamphlet form, and carried by him to New York to be used in getting up the proposed company. It is marked "Exhibit No. 77," and is found on p. 242. It is based on the prospectus already referred to, but contains some most important additions. It commences with the statement that Dr. Herbert W. C. Tweddle proposes to organize a company with the above title and capital ($500,000) to manufacture *illuminating oils, etc.*

After describing the property at Sharpsburg Bridge, the prospectus proceeds to give the more important advantages of Dr. Tweddle's

process as follows, all but one of them, however, being found nearly word for word in the newspaper article previously cited: —

"1st. The use of fire is entirely dispensed with except under the steam boilers, which are situated some distance from the apparatus.

"2d. Danger from fire is entirely avoided, steam being the only agent used; and it is entirely impossible to ignite the oils during the operation; consequently insurance will be reduced to a minimum, and except on warehouse and stock, unnecessary.

"3d. The use of acid or chemicals to purify the oil is dispensed with, as it can be made better, purer, and superior in every respect without them, *while the percentage is increased.* The first test of the oil can be made always from 125° to 130° Fahrenheit, making it a perfectly safe *illuminator.*

"4th. *Refined oil* can be produced at one dollar per barrel less than by present process in use.

"5th. In the present section of apparatus, a period of from seven to ten minutes elapses from the time the crude petroleum leaves the store tank until it is returned to the *refined oil* tank finished oil.

"6th. The whole apparatus is under the control of one operator; there are no laborious details to attend to. The opening and closing of a few valves constituting his entire work, there is no changing of stills, putting on or taking off man-heads, no cleaning out of tar or coke, no bad odor, or dirt, or destruction of apparatus. It works almost automatically, and transforms a disagreeable occupation into a pleasant one.

"7th. There are no waste products. The non-condensible gases are conducted under the steam boilers and utilized as fuel. (Patent No. , granted to Dr. Tweddle, .) *The residuum, after the illuminating oils are obtained, is a heavy, green, lubricating oil, from* 20° *to* 28° *Baumé.* It is almost odorless, and so similar in appearance to the *natural lubricating petroleums from the Ohio and Virginia wells as to deceive the best judges.* It is superior to them, or the best lard oil, for cutting screws or pipes, bolt cutting, drilling wrought iron, and general use of lubricating oils. It will never gum.

"8th. The apparatus can be put in operation in a few minutes, and can be run continuously. It can be stopped instantly, so that it involves no necessity to work on the Sabbath."

Here is a most explicit statement that the *residuum, after the illuminating oils are obtained,* is a heavy green lubricating oil from 20° to 28° Baumé. In the process described in the patent of 1870 the oil obtained, *after the illuminating oils* are obtained, is the Neutral Topaz Oil, a distillate and not a residuum.

But this is not all.

Dr. Tweddle proceeds in the prospectus to state that the year before (which must have been while he was at the Standard Works) he manufactured, from about 90,000 barrels of crude petroleum, 66,000 barrels, or seventy-four per cent, of refined oil, and that by his new process he could produce 6,000 barrels more, or eighty per cent.

This 6,000 extra barrels of illuminating oil would have been worth $8 per barrel, or twenty cents a gallon, amounting to $48,000 in one year. The lubricating oil would, he says, have amounted to 8,000 barrels, worth $5 per barrel, or about twelve and one-half cents a gallon, and would have amounted to $40,000. Not content with this, he goes on to make a formal comparison of what might be obtained from 100,000 barrels of petroleum by the old process and by his own, as follows: —

			"Dr. Tweddle's process.
"Water,	3,000		3,000
"Bonzole,	8,000		8,000
"Illuminating oil,	75,000		80,000
"Tar, coke, non-condensible gases, and loss in refining,	12,000	Lubricating oil,	8,000
"Loss in leakage, handling, and evaporation,	2 000		1,000
	100,000		100,000"

This shows clearly that no such products as Neutral Topaz and paraffine, or paraffine oils of any kind, entered into his estimates of the business of the proposed company.

As we have already pointed out, the process described in his patent of 1870 is said to be the reverse of the old process, by which the object was to decompose the petroleum and produce the largest quantity of *illuminating* oil; but in this prospectus he enters into elaborate calculations to show that he can make larger profits, not because he can make less burning oil, which bore a low price, and make instead a large quantity of a lubricating oil worth twice as much per gallon, but because he can make *more illuminating oil*, a result which required more decomposition of the petroleum.

The inconsistency between Dr. Tweddle's claim, that he endeavored to form this company to make his "*Neutral Topaz*" and other oils, was so manifest that his counsel were compelled to ask him for some explanation of it, as follows: —

"*Int.* 198. In the pamphlet and prospectus put out by you in the summer or fall of 1867, and in the newspaper articles referred to as published in the 'Pittsburg Commercial' of that year, we find no allusion to your production of neutral topaz oil: why was this?

"*Ans.* In 1867 there was no large demand in our home market here for petroleum lubricating oils. The market was for illuminating oils, and the attention of our manufacturers here had not been directed to anything else. I had been the builder of almost every large refinery here during 1861 and 1862. I had also been their instructor in the manufacture of illuminating oils. When I built my Eclipse Refinery at the Sharpsburg Bridge, I knew what valuable products in the shape of lubricators could be obtained from petroleum In the summer of 1867, when I found myself embarrassed for want of capital to carry out my designs, I published the prospectus and pamphlet mentioned I wanted to keep quiet on the subject of lubricating oils, so as not to direct too much attention to it. I wanted to get a good start ahead of any one else, before I talked too much about the special products, which I designed producing largely, and I deemed this the most prudent course to pursue until I had acquired the necessary capital to carry out my plans, and for this reason I neither made any mention of neutral topaz oil or of refined paraffine, but I simply contented myself by saying that it was unnecessary in the manufacture to produce such a large amount of tar and coke, amounting about that time to from eight to twelve per cent of the entire petroleum consumed here, which was about a million barrels annually. This tar and coke are the inevitable products of distillation by fire, or by fire and steam, or superheated steam as auxiliaries. Up to and at this time, tar was almost valueless, and the great majority of that produced was thrown into the Alleghany River. Hundreds of thousands of barrels of tar up to this time and even after this had been so wasted and lost, and even to this day, it is almost a valueless product, not being worth one-half the price of the crude petroleum. Since I commenced the Eclipse Works, early in 1867, I have never made one single pound of tar or coke, and to this day, I am the only manufacturer in the United States who manufactures oils by the use of superheated steam *in vacuo*, with the exception, I may say, of a very small concern in Rochester, New York, who work in direct violation of my patents; at least I believe so.

"*Int.* 199. In your pamphlet published in August, 1867, you speak not only of the burning oil produced by your new process, but also of the heavy green lubricating oil (twenty to twenty-eight Baumé) produced as a residuum; why did you refer publicly to your production of this heavy green lubricating oil, and not to your neutral topaz oil, at that time?

"*Ans* I referred to the heavy green oil, so as to show that our residuum was a valuable, instead of a worthless product, like tar or coke. If I had talked

about oils and products which people here knew nothing about, and which required market to be made for them, they would have been rather shy of loaning me their capital.

"*Int.* 200. There was, then, a market already for the dark, heavy green lubricating oil?

"*Ans.* There was."

Page 229.

We submit that this explanation wholly fails to explain his conduct. He says there was no large demand for lubricating oils in the Pittsburg market. But there was a demand for them in New York and other places at the East, where he went to raise money for his enterprise, and where he carried his prospectus to help along the work, and where also he sold his illuminating oil in 1867 (p. 202, cross-int. 89), and his paraffine, as well as his Neutral Topaz Oil, when he did produce it.

Page 170, int. 121.

He says he "simply contented himself by saying that it was unnecessary in the manufacture to produce such a large amount of tar and coke."

But he did not content himself with saying this. He went on to say that he could make more *illuminating* oil than by the old process; and to show what the increased profits would be, he states, most carefully, that his products would be *illuminating oil, and a heavy, dark-green residuum oil*, worth 12½ cents per gallon, when Neutral Topaz would have been worth four or five times that at least, and although he now says that by pursuing his process of distillation by superheated steam *in vacuo*, he can't produce anything else but Neutral Topaz Oil and burning oil.

Page 174, int. 142.

Such is his present claim; but in 1867, in his prospectus, he claims to produce illuminating oil and a residuum oil, a larger percentage of the former, and he publishes far and wide, in a Pittsburg paper, a report of a trial, in which he did, in fact, produce just what he claims in his prospectus to produce, — illuminating oil and residuum.

It will be observed that at the end of the prospectus, Exhibit No. 73, published in the Pittsburg "Commercial," and also in the one published as a pamphlet, Exhibit No. 77, it is stated that "specimens of the products can be examined and compared with those by the old process, at the office of S. M. Kier, Liberty Street." But S. M. Kier has not been called to prove that among these products was Neutral Topaz.

Letter to John M. Merrill.

About the time that Dr. Tweddle was thus zealously engaged in the effort to convince the public, or at least capitalists, that his new process possessed great advantages over the old process, he was led, by a notice in the papers that a brother of the plaintiff had been badly burned in the refinery of the Downer Company, at Corry, Pa., to write him a letter, in which, after alluding to the accident, he explains the advantages of his new process as follows: —

"In my new works I think that the oil refining business is divested of all the attendant dangers of the old process. The crude oil is run into the apparatus and is returned to the refined oil tank finished oil, inside ten minutes, without being exposed, without using any other agent than steam; acid, alkali, or any other chemical treatment being entirely dispensed with, and the oil produced is superior to any that has ever been made by the old process; all danger, dirt, filth, or odors are avoided. When my apparatus is completed, one man and a boy can make a thousands barrels daily easier than they could produce ten the old way.

"Your long practical experience I feel sure will enable you to appreciate the many advantages of this process. Aside from its great economy, *the lubricating oils which result are equal to the best natural oils of Virginia and Ohio*, and more than pay the cost of manufacturing and coopering and barrelling of the refined; in other words, I can produce the refined oil at fifty cents per barrel against $1.50 to $1 80 by the old process."

Page 522.

Here he speaks of but two products,—refined (illuminating) oils, superior to any ever made by the old process, and the resulting lubricating oils, which are equal to the best natural oils of Virginia and Ohio, and more than pay the cost of manufacturing and cooper-

ing and barrelling the refined. As he puts the cost of producing the refined oil at fifty cents per barrel, it is obvious that he could have referred only to the residuum oil, which is of low cost, and that he must have expected to produce but a small quantity even of that. Such a result in lubricating oils implies a larger percentage of illuminating oils than the old process, just as he claimed in the newspaper articles would result from his process, thus proving that the cracking process was to be practised.

Transactions with the Lightfoot Company.

So far the circumstances relied upon to show that in 1867 Dr. Tweddle could not have had knowledge of this invention, occurred in that year; but we now come to the acts of the doctor a year later, and they are equally inconsistent with the assumption that even then he knew and practised the invention.

It appears that a company in Philadelphia, called the Lightfoot Currying Oil Company, had patents for the use of paraffine oil for currying purposes; but that it did not manufacture such oils, but purchased them in 1868 of Messrs. Seccomb, Kehew & Thayer, of Salem, Mass. This company sold oil for currying purposes under three different names or designations, to wit: a stuffing oil called "A," a finishing oil called "AX" oil, and an oil for oiling off called "AAX" oil. Samples of these three oils have been produced, marked "Exhibits 103, 104, and 105."

Page 371.

In 1868, if not earlier, a company in Rochester engaged in the manufacture and sale of a stuffing oil, which interfered with the business of the Lightfoot company. This oil was made by a vacuum process, and a sample like it has been introduced, marked "Exhibit 106." It is a dark green residuum oil.

In August, 1868, Mr. Toppan, agent of the Lightfoot Company, hearing of Dr. Tweddle, went to Pittsburg to see about procuring a similar stuffing oil from him. (Page 372, ints. 16 to 22.) At that time Dr. Tweddle had completed his two additional stills and had resumed the distillation of oil. Mr. Toppan went to Dr. Tweddle's refinery, and the doctor being absent, explained the object of his visit to the foreman. He says the foreman showed him what they were making, and that what he showed him was burning oil and a heavy, dark, black oil. (Page 372, ints. 23 to 29.) Mr. Toppan says (ints. 30, 31) that the foreman gave him a sample of the dark-colored oil which he produces as an exhibit, marked "Exhibit No. 107."

He also says that he explained to the foreman that if he could get a light-colored oil as free from odor, etc., as the Rochester oil, it was just what the Lightfoot Company wanted, and that he was told in reply that they were not making such oils.

The next day, Mr. Toppan says he had an interview with Dr. Tweddle, in which he explained to him the object of his visit (p. 373, int. 34); that among other things, the doctor told him "that his great object was to get burning oil distilled by the vacuum process, and that his great drawback was the per cent of heavy oil which he had left, which he had a limited market for." Toppan also says (p. 374) that Dr. Tweddle "*stated distinctly that he was making no light-colored oils that he could substitute for the finishing or oiling-off oil;* but he thought, by a little management, he might produce something that would serve the company better than the oils they were then using."

Now, is it possible that Dr. Tweddle could have had a hundred barrels or more of the distillate from which Neutral Topaz could be produced by removing the paraffine, and not produce it for the examination of Mr. Toppan?

A year later he, or his agent in Boston, did send two samples of Neutral Topaz Oil, which Mr. Toppan and Mr. Lightfoot say would have been admirably adapted to the purposes of the Lightfoot Company.

Toppan, p. 376, ints. 56 to 60.
Lightfoot, p. 389, int. 17.

Though he did not show Mr. Toppan any light-colored oil while he was in Pittsburg, yet a few days after he did send him a sample, preceded by a letter, as follows (p. 247) : —

"ECLIPSE PETROLEUM REFINING WORKS,
PITTSBURG, PA., Aug. 21, 1868.

"C. TOPPAN, ESQR.,

"*Dr. Sir:* — I am in receipt of your valued favor of the 7th inst. and note contents. Within a few days I will forward to Mr. Bartlett *some light-colored oil, which I think will be admirably adapted to the purposes of the Lightfoot Co.* He will submit it to your inspection, and if it suits I will manufacture it in any quantity that you desire. I have been so busy on large contracts for refined oil that I have not had time to make the dark-colored oil, but will commence on Monday to do so, & will forward some of it. I have not yet received the document which you mention, authorizing me to sell in the Eastman territory. I will be happy to be present at the meeting of your Lightfoot Co. in Sept.

"Yours very truly,
"HERBERT W. C. TWEDDLE.

"I have sent some samples of Tanner's oil to Jno. R. Bartlett, Boston, which he will submit to your inspection. One bottle is heavy and much thicker than samples you left, to show you that we can make it thick; the other sample is a very little thicker than the sample you left, and fulfils, I think, all the requirements that you desired me to do."

The samples of light-colored oil above referred to are produced by Mr. Toppan as exhibits, marked Nos. 108, 109. They are obviously anything but Neutral Topaz.

When Dr. Tweddle's attention was first called to this letter (p. 218, cross-int. 255), and he was asked what that oil was, he replied, "Neutral Topaz, from which the paraffine had not been abstracted." And though in his next answer he qualifies his statement by saying, "It might be light-colored amber oil, or it might be the last run of the paraffine distillate, or from the first run of paraffine distillate. I cannot positively state what the samples were," his first answer is in effect that he naturally would have sent Neutral Topaz with the paraffine in if he had had it. He could not have failed to know that an oil free from odor was desirable for such uses.

This letter is a complete contradiction of the assertion made in his answer to cross-int. 223, p. 215, that he did not offer to sell his

oil to the Lightfoot Company on account of his unwillingness to interfere with the trade of Messrs. Seccomb, Kehew & Thayer.

Mr. Toppan's visit, it seems, led to a sale of a thousand barrels of the dark-colored residuum made by the doctor to the Lightfoot Company, and to a negotiation in regard to the sale of all kinds of paraffine oils for tanners' or curriers' use by Dr. Tweddle, which proceeded so far that he advertised the sale of the various oils designated as stuffing, finishing and oiling-off oils, and the two last under the trade-marks AAX and AX.

His circulars relating to these oils are marked "Exhibits Nos. 78, 79," pp. 244, 245. Both were printed in September, 1868.

On pp. 215, 216, on cross-examination, he is referred to these circulars, and asked what the various oils were, and he answers (p. 216) as follows: —

"*Ans.* The gravity of the dark-green stuffing oil was from twenty-five to twenty-seven gravity. It was dark green in color. The *a a x* and the *a x* were paraffine oil, or Neutral T paz Oil with the paraffine in; were about thirty-four gravity, and, as far as I remember, were one and the same thing. I think that the users of this oil were told to mix whale oil, or something, with it. The green stuffing oil was what remained after the illuminating oils and the paraffine oils were distilled off. The *a a x* oil and the *a x* oil were paraffine oil, distilled off to obtain the green stuffing oil; on the amount taken off depended the gravity of the heavy green stuffing oil."

Thus we have the oils he advertises clearly identified as a paraffine distillate before the paraffine is removed, just what he says the hundred barrels of heavy distillate were, which he carried over from the summer of 1867 to the late fall or winter of 1868.

And yet he never showed this oil to Mr. Toppan when he was making inquiries for oils with less odor, neither does he send him a sample of it when, a few days after Mr. Toppan's departure, he sends him samples of a light-colored oil which he says *he thinks will be admirably adapted to the purposes of the Lightfoot Company.*

See Letter of Aug. 21, 1868, p. 247.

Nor is this all. Two other members of the Lightfoot Company

testify that they expressed to him the importance of procuring finishing oils as free from odor as his stuffing oils, and that he not only did not show them any such oil, but disclaimed his ability then to make it. Mr. Lightfoot visited the doctor at Pittsburg, Nov. 27 and 28, 1868, and he testifies as follows about a conversation with the doctor: —

"*Int.* 15. While you were at Pittsburg, did you have any conversation with the doctor about the character of his stuffing oil, and about procuring from him any finishing oils? If so, will you state when and where such conversation took place, and what the conversation was?

"*Ans.* The only conversation that I remember between Dr. Tweddle and myself, in reference to the oils, was in passing from his office to the office of his attorney. I said that if we could get an oil as sweet as the stuffing oil, which would be suitable for oiling off, it would be very desirable. He said that he did not know as we could do any better for the present than use the AAX, manufactured by Seccomb, Kehew & Thayer, but he thought he would soon be able to make an oil of as light a color as the AAX, and as sweet as the stuffing oil."

Page 389.

Mr. Winn met Dr. Tweddle at Philadelphia, in the fall of 1868. and he testifies as follows to a conversation with him at that time: —

"*Int.* 7. If you had any conversation with the doctor at that time about the manner of using these oils, or about the qualities which it was desirable they should possess, will you state what the conversation was?

"*Ans.* I stated distinctly at that time the importance of all the oils that were used in currying leather to be as free from odor as possible, making a statement of the trouble of having common oils that were full of odor, in giving curried leather a bad smell, as we have to use those oils in connection with fish oils. I also explained to him the manner in which those oils could be successfully used, and also agreed to send him a printed statement of the manner of mixing, and I did so, or caused it to be done.

"*Int.* 8. If you said anything to him about the parties of whom you procured your AX and AAX oils for finishing, and about the qualities of the oils you procured of them, state what you said to him and what the doctor said in reply, if anything.

"*Ans.* In the statement made upon the mode of using the oils we termed stuffing oils, AX and AAX oil, meaning three grades of oil that we recommended the use of, those oils from Seccomb, Kehew & Thayer, because they were the most free from odor I had before explained to him the great importance of having it so. I think the doctor says you won't be able to get any better oil than you get from them, in that particular.

"*Int.* 9. State whether or not the doctor said anything to you about supplying

you with finishing oils AX and AAX, as well as with the heavy, dark-green stuffing oil.

"*Ans.* I think he did not."

Page 394.

Over and above all this, in appears that a negotiation for the sale of paraffine oils under the Lightfoot patents embraced an arrangement that Dr. Tweddle should be furnished with the finishing oils from the manufactory of Seccomb, Kehew & Thayer.

This is explicitly testified by Messrs. Cobb and Toppan.

Mr. Cobb testifies (p. 391) as follows about an interview with Dr. Tweddle, at Philadelphia, in the fall of 1868: —

"*Int.* 3. If you were present in the fall of that year at an interview in Philadelphia, between some of the officers of that company and Dr. Tweddle, of Pittsburg, will you state as nearly as you can when the meeting was, who was present, and what was the object of the interview with him at that time?

"*Ans.* I was present at an interview with Dr. Tweddle, in September, 1868, with some of the directors of the Lightfoot Company. Mr. Winn was there, I remember, and some of the directors from Philadelphia, and the treasurer was present. The object of the interview was to see if we could make an arrangement with him to furnish the company with stuffing oil, and also to license him to sell the oil for currying purposes.

"*Int* 4. State whether or not, at that interview, there was a verbal arrangement made for granting Dr. Tweddle a license, which it was understood was to be subsequently reduced to writing and was to be executed by the parties.

"*Ans.* There was such a verbal arrangement made.

"*Int.* 5. State, as nearly as you can, what the arrangement was.

"*Ans.* The arrangement was that he should sell the oil for currying purposes, and that he should pay the Lightfoot Company a royalty of three cents a gallon on all the oil he sold.

"*Int.* 6. Will you state whether or not anything was said at that time about his purchasing oils of Seccomb, Kehew & Thayer for finishing purposes? If so, state what it was.

"*Ans.* He was desirous of selling the finishing oil made by Seccomb, Kehew & Thayer, and we were also anxious that he should sell it, and he agreed, or was to agree if the agreement had been consummated, that he would purchase the finishing oils of Seccomb, Kehew & Thayer, and would pay us a royalty of three cents a gallon on all the oil so purchased of them.

"*Int* 7. At what price was he to purchase the oils as compared with the price which the Lightfoot Company itself paid?

"*Ans.* He was to pay the same price which the Lightfoot Company paid for it.

"*Int.* 8. If you have in your possession any paper written by you after that interview, and while its particulars were fresh in your mind, and from which you have refreshed your recollection, will you state what the paper is, and produce it as an exhibit?

"*Ans.* I have a letter which I wrote to Mr. Lightfoot, the treasurer of the Lightfoot Oil Company, written in December, 1868, which I produce to be marked 'Exhibit No. 116.'"

The letter to which Mr. Cobb refers as refreshing his recollection is found on p. 604 and 605, and contains this remarkable passage: —

"☞ The understanding with Mr. Winn and myself was in accordance with our conversation with Tweddle in Philadelphia, in September, *that he should procure the finishing oil of Seccomb & Co., at the same price that the company pay them for it, we to have three cents royalty from Tweddle in it; and therefore we do not wish in the license to say anything about the finishing oil, nor is it necessary, as the oil obtained of them will be already branded by the Seccomb Co.*"

Mr. Toppan testifies as follows, (p. 392): —

"*Int.* 47. You said that the barrel of your AAX finishing oil made by Seccomb, Kehew & Thayer was sent to the doctor, at his request. State, if you know, the reasons why he wished to procure that barrel.

"*Ans.* He wished it as a sample, as he was going to try and attempt to make an oil that he could sell from his place as a finishing oil.

"*Int.* 48. Will you state whether or not he did, while you were in communication with him in the fall of 1868, produce and show to you any oils suitable for finishing oils?

"*Ans* *He wasn't able to even show us anything that approached in quality or color the oils that we were then selling as a finishing oil, — our AAX oil. The doctor was very desirous to do it, but he never accomplished it.*"

. . . . . .

"*Int.* 51. In these circulars, the AX oil for oiling off and the AAX for finishing are apparently included among the oils which the doctor offers to curriers for use in their business. State, if you know, how the doctor was to procure those oils for his trade, if he was unable to manufacture them.

"*Ans.* There was a verbal understanding that he was to procure them of Seccomb, Kehew & Thayer.

"*Int.* 52. State, if you know, what the terms of that understanding were, and whether any of those oils were furnished to the doctor under such understanding.

"*Ans.* As I understood it, he was to buy the oils of Seccomb, Kehew & Thayer at the same prices the Lightfoot Currying Oil Company were paying, the doctor to pay his royalty of three cents a gallon to the Lightfoot Company. I am very positive that he had one or two lots of oil sent him, but I couldn't give the dates.

"*Int.* 53. Do you know the quantity in those lots, and whether they were sent directly to him or not, or to other parties named by him?

"*Ans.* I couldn't tell the quantity. The oil was shipped to Dr. Tweddle direct."

Dr. Tweddle, on p. 471 to 474, under objection, denies some of these statements in a qualified manner and to some extent admits them, and attempts to explain them by saying that he was not at that time prepared to furnish oil with the paraffine removed. But in his previous deposition he had stated most explicitly that the AX and AAX oils, for finishing and oiling off, which he was advertising for sale, were Neutral Topaz with the paraffine in, and were superior to the oils manufactured and sold under the same designations by Seccomb, Kehew & Thayer.

We submit that even with all the explanations he has made, it would have been morally impossible for him not to communicate the fact that he had such an oil as Neutral Topaz with the paraffine in, and exhibit the oil if he had in fact had it; and as he does not even pretend that he did so, the circumstance can only be accounted for on the assumption that he had not done what he claims to have done.

Admissions to Byron M. Peck.

About the time, apparently, that the negotiations with the Lightfoot company were dropped, another witness made a business acquaintance with Dr. Tweddle. This witness is Byron M. Peck, who was in business in Pittsburg in the latter part of 1868 and the commencement of 1869, as a member of the firm of J. H. Pease & Co. He had been for some time in the oil business, and was, therefore, a competent judge of the qualities of oils, and as he was selling paraffine oils he was directly interested in comparing the doctor's oil with those he was selling.

He thus describes the oil he was then selling (p. 333): —

"*Int.* 7. When you commenced in November, 1868, with J. H. Pease & Co., if that firm had any paraffine lubricating oils which they sold, state what the character of such oils was, and of whose manufacture.

"*Ans.* They had such oils. They were products of petroleum, called paraffine oil, manufactured by Moorhouse, Merriam & Co., of Cleveland. They were of a light straw color, very clear and transparent, and gravities from 23 deg. to 25 deg.

Baumé, and the most odorless of any oils that I had any acquaintance with, and also freer of the bluish or greenish tinge."

The witness had two interviews with Dr. Tweddle, soon after he became a member of his firm, which he thus describes (p. 333) : —

"*Int.* 9. State whether or not, at or about the time you became connected with the house of J. H. Pease & Co., you saw Dr. Herbert W. C. Tweddle, of Pittsburg; and if so, state, as nearly as you can, when and where you saw him, and how you came to see him.

"*Ans.* I did see him, at the office of Lockhart & Frew, where he had his office, in December of 1868 or January of 1869. My attention was called to him by the firm of S. McLean & Son, bankers.

"*Int.* 10 If that interview with him was in relation to business, state what the business was and what passed between you.

"*Ans.* I called for the purpose of getting the sale of his oils, or making purchases; more particularly desirous of getting the dark-green oil for the trade of Eastern Pennsylvania. He had nothing upon which we ever agreed upon in the prices, that suited us; and after the green oils were dropped, he called my attention to a light, transparent oil, that he called spindle oil. He stated that he was selling it largely to the East, and it was giving good satisfaction for light, rapid machinery. I was not willing to admit that it was much superior to the oils I was selling myself, of Cleveland manufacture, at much less prices than his.

"*Int.* 11. State whether or not you had, after that, another interview with Dr. Tweddle while you were with the firm of J. H. Pease & Co., and, if so, state when and where it took place, and what, if anything, passed between you on such occasion.

"*Ans.* I had another interview with him, I think in February, 1869, at the office of J. H. Pease & Co., of Pittsburg. He called for the purpose of purchasing five hundred barrels of the Cleveland paraffine oil, and wanted to know if I would agree to deliver that amount of oil at forty-five cents a gallon, in Pittsburg. I could not do it, for the reason that the Cleveland folks were behind their orders, and it was uncertain when they could be able to ship any oil to Pittsburg again. Odors and qualities were discussed generally. I claimed that the Cleveland oils were, in my opinion, about equal to his, and preferable on account of the difference in price; that they were nearly if not quite as free from odor as the sample he had previously shown me. He stated there that that was not a fair sample of what he could or would shortly produce, in the way of odorless oils.

"*Int.* 12. How did the Cleveland oil compare with Dr. Tweddle's oil, a sample of which you saw, as to gravity?

"*Ans* There was a difference of about seven degrees; the Cleveland oil, the sample we were discussing, being about twenty-five degrees, and he stating that his was about thirty-two degrees.

. . . . . .

"*Cross-Int.* 64. What description of smell did the spindle oil have which Dr.

Tweddle showed you in February, 1869? Was it or was it not the same kind of smell as the oil of which you got a sample in February, 1870?

"*Ans.* I've not stated that he showed me any oil in February, 1869. It was in December, 1868, or January, 1869.

. . . . . .

"*Cross-Int* 71. What was the price of the Moorhouse, Merriam & Co. oil at the time?

"*Ans.* About forty-five."

This witness was certainly competent to judge of the characters of oils; he had a sufficient motive for making a correct comparison. Dr. Tweddle admits (p. 463, ints. 6, 7, 8) that he had such interviews with this witness; and though he denies that he had any idea of purchasing oils of the witness, he admits that he talked with him or his partner about oils, to draw him out, and he suggests that the witness was irritated by his refusal to sell to him except for cash. But we submit that the testimony of the witness shows no signs of any feeling against Dr. Tweddle. On the contrary, he seems to be singularly free from any bias or feeling. But though Dr. Tweddle hints that the witness may have been irritated, he does not deny a word of what the witness says about their conversation in regard to the quality and characteristics of his oil at that time (December, 1868, or January, 1869). This is the more significant as the witness was closely cross-examined in relation to the oil Dr. Tweddle showed him, and the doctor does attempt an account of a later interview, and does not deny that he showed Mr. Peck samples, nor that they were such as the witness describes.

Another interview took place about a year later between Dr. Tweddle and the witness, which the latter thus describes (p. 334).

"*Int.* 13. Did you at any time have another interview with Dr. Tweddle? If so, state when and where it was, and how you came to have such interview with him.

"*Ans.* It was about a year from the last, February 9, 1870. I had learned of his having made improvements in his oils. The interview took place at Pittsburg, at the office of Lockhart, Frew & Co. I was then on a trip South, selling. I called on him for the purpose of getting the sale of his oils, provided he had made the improvements that I had heard he had. I was selling on commission at the time, and my object was to increase my sales for the purpose of making more money. I stated to him what my object was, and what I had learned; and also that I had never seen any of his oils that I considered anything very superior. He stated

that he had recently made improvements in his works and in his productions, and showed me a sample called Neutral Topaz. It was superior to anything I had ever seen of his productions. He was willing that I should take samples, but after learning the route that I was going, didn't think I would have much chance of selling. He stated that this production was the best that was produced anywhere in the world. I took a sample with me, but never made any efforts, the points that I had reached having been previously canvassed by his agents.

"*Int.* 14. If Dr. Tweddle at that interview said anything as to the nature of the improvement he had recently made in his oil, state what it was.

"*Ans.* He did; that the improvements were in odor and in color more particularly; that they were neutral, as the name indicated, being nearly water-white and free from odor.

"*Int.* 15. State whether anything was said by him, and if so, what, as to the freedom of those oils from the bluish or greenish tinge referred to previously by you. I mean the neutral topaz oil.

"*Ans.* He did refer to the tinge or color, and said that he had succeeded in removing that almost entirely or quite; that the neutral oil could be mixed with animal oils without showing that tinge,— a feat that had never been previously accomplished by any one. I referred to the sample that I had seen about a year previous, as showing that tinge very plainly. The doctor said that he had since that time improved on that point as well as in color and odors, and that it would do all he had claimed for it in every particular.

"*Int.* 16. At the previous interviews, had the doctor used the term 'neutral topaz' as applied to any of his oils?

"*Ans.* I don't remember that he did.

"*Int.* 17. How did this neutral topaz oil he showed you at the last interview, as to its odor, compare with the oil of Moorhouse, Merriam & Co., as it was made the year previous and at the time of the last interview by their successors, and with the samples of Dr. Tweddle's own oil which he had previously shown you?

"*Ans.* It was very much superior in that respect, being almost entirely odorless. Either of the other productions were not nearly odorless.

"*Int.* 18. What was the character of the odor produced by the other productions? I mean the oil of Moorhouse, Merriam & Co., and that shown you by Dr. Tweddle the year previous.

"*Ans.* They had the odor of paraffine distillate, both of them."

The nature of this interview was such that the witness could hardly be mistaken as to what was said, especially about the samples of oil he was undertaking to sell.

Dr. Tweddle admits (p. 464, int. 9) that he had an interview, and he does not deny that the occasion was what the witness says it was, or that he gave him samples as the witness states; but he denies that he told him that he had made improvements in his oil, either in odor or color, or that he told him that he made Neutral Topaz water-white, or nearly so.

We submit that the testimony of this witness is not impaired by the denials or explanations of Dr. Tweddle; and that it establishes these facts, to wit, that in December, 1868, or January, 1869, the doctor showed the witness samples of an oil which he called spindle oil, and which was not Neutral Topaz; that in February, 1869, he claimed that he could or would soon produce better samples; and that in February, 1870, he told the witness he had recently made improvements in his productions, and showed and gave the witness samples.

Henry C. Colgate.

Another witness, Henry C. Colgate, formerly a selling agent of Dr. Tweddle's oils, has been called by the plaintiff. He commenced his agency in March, 1868, the date being fixed by a letter marked "Exhibit 120," on p. 443, and dated Pittsburg, March 21, 1868. It is as follows: —

"PITTSBURGH, March 21, 1868.

"HENRY C. COLGATE, ESQ.:

Dear Sir, — The samples have both gone forward. Will send you in a few days printed certificates. Am a little afraid that it is too cold to introduce it yet.

"Yours very truly,

"HERBERT W. C. TWEDDLE."

The certificates referred to in the letter were forwarded in a short time. One of them is produced as an exhibit, No. 121, on p. 444. It commences as follows: —

ECLIPSE PETROLEUM REFINING WORKS.

NON-EXPLOSIVE ILLUMINATING OIL, SIGNAL LIGHT OIL, FOR RAILROADS AND STEAMERS.

"These oils are offered to the public as the safest, best petroleum oils made, photometrical test proving them superior to any oils hitherto manufactured. They will not smoke the chimney, grease the outside of lamps, or create a disagreeable odor in a room, as all oils which are refined by the use of acids and chemicals do,

and will burn the deepest lamps dry without crusting the wick. No one need hesitate about burning these oils, as they are all submitted to the severest tests before leaving the works.

"BENZOLE, GASOLINE, RHIGOLENE.

"*Manufactured by steam in vacuo, under Patents granted to* DR. H. W. C. TWEDDLE, *Producer of the celebrated* ECLIPSE LUBRICATING OIL, *in use on all the Railroads, Iron Mills, Machine Shops, Saw Mills, etc., in the vicinity of Pittsburgh, and proved to be superior and more economical than any Lubricator in use, — absolutely free from water, grit, gum, or other impurity, — will stand the greatest heat without change.*"

Then follow several certificates of different parties to the value of the Eclipse Lubricating Oil, which the doctor says was his heavy, dark-green residuum oil.

This witness visited Dr. Tweddle's refinery at Sharpsburg Bridge in May or June, 1868, and he gives this account of the oils he saw there.

"*Int.* 9. State whether or not you visited Doctor Tweddle's refinery, called Eclipse Refinery, near Sharpsburg bridge in the spring of 1868.

"*Ans.* I think it was not exactly in the spring of 1868. I visited it several times in the year 1868. I think the first time was in June, 1868. I might have been there in May, but I think it was in June.

"*Int.* 10. State whether or not the doctor showed you about his refinery, and showed you the oils which he had on hand; and if so, state what kind of oils you saw and what quantities.

"*Ans.* He showed me through his works; all I saw was two oils. They were a head light oil, which is carbon, an oil, I think, of a test of about one hundred and seventy or one hundred and seventy-five, and the other oil was the Eclipse Lubricating Oil. There were a large number of barrels of what I thought head light oil; the brands of the barrels the same as the head light oil; a large tank which I think had in it the same kind of oil. [Then there was a tank filled full of Eclipse Lubricating Oil; one tank held I should think a hundred barrels or more. I did not see the tank for the head light oil, only saw the faucet where it was drawn."

Page 409.

He saw no light-colored paraffine oil like Neutral Topaz, although according to Dr. Tweddle and Clark there was then stored there a hundred barrels or more of Neutral Topaz with the paraffine in.

Now, if Dr. Tweddle did have, in the summer of 1868, such an oil, it is most extraordinary that he should not have offered it for sale through this agent who was travelling to sell his Eclipse Lubricating Oil.

In the spring of 1869, it might have been in January, the witness says he saw at Dr. Tweddle's office, in Pittsburg, light-colored lubricating oils, of which samples were afterwards, in May or June, sent him. (Page 409, ints. 4, 13, 14, 15.)

About the same time he received a letter from Dr. Tweddle in relation to this oil, with a price list of the different oils, which he thus describes: —

"*Int.* 16. State whether or not, about the time you received the samples, you received a letter from the doctor, making reference to them. If so, state as nearly as you can what the date of such letter was, and where the letter now is, if you know.

"*Ans.* The letter was received in the latter part of April or May, stating that he had sent me samples, and a price list of the different kinds of oils he was making. It consisted of a spindle, woollen, neutral, or Neutral Topaz Oil, paraffine, and Eclipse Lubricating Oil, summer and winter lubricating oil, two kinds. The letter I gave to Doctor Tweddle, and the price list.

This letter and price list the witness says he gave to the doctor on the 26th of June, 1871, together with other letters, price lists, circulars, and two samples of oil. It appears that he went to Pittsburg, in response to a dispatch from Dr. Tweddle, expressly to deliver these things.

Page 410, ints. 17 to 22.

The plaintiff, before the examination of the witness, had given the counsel of defendant notice to produce the letter first named and all other letters, and at the examination of the witness these letters were called for (p. 410), but they were not produced.

The reason Dr. Tweddle telegraphed to have these letters brought to him by the witness, and why he retained them, may be easily inferred from one question and answer on the cross-examination as follows (p. 412, cross-int. 11): —

"*Cross-Int.* 11. Before your visit to Pittsburg in June, 1871, when you came at the request of Doctor Tweddle, as you have stated, did you not see Doctor Tweddle at the house of his counsel, H. Blakewell, and make a statement to him, to the following effect, in substance or in words as follows: That in July, 1868, you commenced to sell his heavy paraffine oil, neutral, light yellow and deodorized; that Doctor Tweddle sent you samples several times; that the first samples were in bottles with paper wrapped around them, and that the next samples were sent in tin boxes; that you sold this oil to several parties; that you didn't know what they bought it for, but that it was sold as a mixing oil?

"*Ans.* Yes. I told them I couldn't tell until I examined my letters. I told them that at that time I wasn't certain whether I sold it in 1868 or 1869. *Doctor Tweddle tried to impress upon my memory that I sold it in* 1868. *I told them that when I got home and examined my letters, I would tell them when I sold it, which I did by answering by telegraph.* I mean that the conversation related to light oils. Doctor Tweddle sent me samples several times, of different kinds of oil, several times in 1868 and 1869. The first samples were the Eclipse lubricating oils sent to me in bottles with paper wrapped around them; that was in 1868. In 1869 he sent me samples of light oil in tin boxes. The first samples that I had sent to me of eclipse lubricating oil was sent to me in small bottles with paper wrapped around them in boxes. The light oils I may have sold. I never asked what they were going to do with them."

The oil, which was the subject of the first letter called for was the Neutral Topaz, as appears from cross-int. 9, p. 412:—

"*Cross-Int.* 9. What was the name of the samples of light-colored lubricating oils which Doctor Tweddle sent you in the spring of 1869?

"*Ans.* Paraffine oils and a light oil which is used for mixing with other oils. I won't say wether it was a neutral oil or Neutral Topaz Oil. I cannot exactly say the name. I think it was a neutral oil for mixing. Then there was a woollen oil sent me. The mixing oil may have gone by the name of Neutral or Neutral Topaz. The only thing I sold it for was mixing."

And from the 11th cross-int. (p. 412), it appears that prior to the time the letter was given up an interview had been had with the witness in reference to the sale of this oil, and that Dr. Tweddle had tried to impress it on the mind of the witness that he commenced to sell in July, 1868; that the witness was doubtful as to the time, and wished to examine his letters, and that he did so, and telegraphed the result of the examination. It is clear that these letters and other papers must have fixed the time of the first sales of the Neutral Topaz by this witness in 1869, and therefore the letters have not been returned.

Samuel Downer's Statement.

In his direct examination Dr. Tweddle testified as follows (p. 178, int. 176) in respect to showing his Neutral Topaz Oil in 1868: —

"Mr. Downer called in our office in 1868, after the month of May. I can't fix the time. I showed him my products; among the rest was the Neutral Topaz Oil. He never said anything about the Merrill patent oil. It was the office of Lockhart & Frew, No. 74 Wood Street, in the city of Pittsburg. I frequently conversed with Mr. Downer since then, and until the fall of 1869, or early in 1870. I never heard him mention anything about the Merrill oil."

The date of Mr. Downer's visit at Pittsburg in 1868 is fixed by Mr. Downer himself by a diary, from March 3 to the 11th. At that time he saw Dr. Tweddle at Lockhart & Frew's, and while there he wrote a letter to one of his partners in which he states what he had seen of Dr. Tweddle's oils.

"Dr. Tweddle showed me a list of fires in oil works since the commencement. The list is long and perfectly fearful. He does this because he considers his way takes away all risk. Tell Joshua one of his numerous patents is dropping oil on pipes heated by superheated steam, and running through a vacuum whilst being dropped on. I have seen his oil. His products are naphtha, twelve per cent about; illuminating oil, sixty-three per cent about; lubricating, about five per cent; residuum, seventeen per cent, waste three per cent; no alkali or acid."

The next day, March 8, he wrote again as follows (p. 401):

"Dr. Tweddle offered to carry me to see his process, but I had not time, and it was too unpleasant. This seventeen per cent residuum is very sweet, but without any show of paraffine; was not liquid in the warm office, and is, the doctor says, very thick. If I understand him right, he drizzles oil in a vacuum, on pipes heated by superheated steam, and this seventeen per cent of residuum is running out the whole time at the bottom. The doctor talks large, but I fear he has already embarrassed himself. His white oil, without acid or alkali, does not stink, but it has not a marketable smell. That is a dodge nobody yet seems to have got hold of but us. He is spending money, and sanguine. If he succeeds there, an oil factory is boilers for steam and a vacuum pot. Lockhart thinks he will succeed."

So far, the report of this interview is wholly independent of Mr. Downer's recollection. But he has told what he recollects of the character of the oil.

"I was at the office of Lockhart & Frew, as stated in that letter. I rely from memory chiefly from the letter, but not entirely. When in the office of Lockhart, Frew & Co., I saw, I think, Mr. Frew and Mr. Gracie, and Dr. Tweddle. The sam-

ples were shown to me. My attention was principally directed to the illuminating oil, but I noticed both the lubricating and the residuum. I feel quite confident the lubricating was a lemon-yellow color, partially chilled, showing paraffine crystals, *with the usual still smell*, and somewhat thinner than the paraffine oils of commerce."

Page 401.

It is clear, from this description, that the lubricating oil which he saw could not have been Neutral Topaz. What he calls the usual still smell, he defines on p. 406, cross-int. 7, where he clearly distinguishes it from the smell of Merrill's oil and Tweddle's Topaz Oil.

In addition to this, on p. 401, int. 10, he tells us that he first saw Tweddle's Neutral Topaz Oil in the summer or late in the spring of 1860, at which time it was offered for sale.

But one most important fact is fixed by the testimony of both Dr. Tweddle and Mr. Downer, viz: that in March, 1868, Dr. Tweddle's oils, whatever they were, made by his new still, by the aid of steam and vacuum, were on exhibition at Lockhart & Frew's and that they were the subject of conversation between Mr. Downer, Dr. Tweddle and two members, at least, of the firm of Lockhart & Frew, viz: Mr. Frew and Mr Gracie.

Now, neither of these last-named gentlemen have been called to support Dr. Tweddle in his statement that he showed Mr. Downer his Neutral Topaz in their office in 1868, nor has any member of the firm of Lockhart & Frew, nor any clerk, been called to testify that Dr. Tweddle had such oils in their office in 1868; yet they, of all men, must have known of his Neutral Topaz Oil, if he had had it. Mr. Gracie was, in fact, called as a witness, but not a word was asked him as to his first knowledge of Neutral Topaz Oil. This failure to call upon these men or Mr. Kier, who had Tweddle's oils on their premises and for exhibition, to prove that Neutral Topaz was among them, ought, of itself, to be considered conclusive that Dr. Tweddle had no such oil in 1867 or 1868.

The last statement in Dr. Tweddle's answer above quoted is proved to be untrue, and we call attention to it here as another illustration of the unreliable character of his testimony in the case. He says:—

"I frequently conversed with Mr. Downer since then (May 1868), and until the fall of 1869, or early in 1870. *I never heard him mention anything about the Merrill Oil.*"

Now Mr. Downer testifies that in October, 1869, he had a long conversation with Dr. Tweddle in reference to his Neutral Topaz Oil, it which he claimed that it was an infringement on Merrill's patent, and he has produced in evidence in support of his testimony a letter written by him at the time to the plaintiff, in which he gives the details of this conversation and the statements made by Tweddle.

Downer, p. 402, ans. 12.

There can be no question of the fact that such a conversation took place, and that it was substantially what Mr. Downer has testified, and the Court will perceive from its character that it is exceedingly improbable that Dr. Tweddle should have forgotten it. If he did, his memory is too poor to be relied upon.

After the close of the complainant's testimony in rebuttal two witnesses were examined by the defendant, under objection, as to their knowledge of Tweddle's lubricating oil in 1867 and 1868.

Joseph Musgrave testifies to seeing an olive-oil colored lubricating oil made by Tweddle in October 1867. Of its odor he says, "The oil was not unpleasant; it was nearly odorless."

Record, p. 462, ans. 18.

This description certainly does not identify it with the Neutral Topaz, and the witness is not asked to compare it with the oil now known by that name.

Edward S. Thayer, who was examined at an earlier stage of the case and said nothing about the Neutral Topaz, on being recalled testified to ordering five or ten barrels of lubricating oil on the 23d of October, 1868, of Dr. Tweddle, which he says was Neutral Topaz, and that he had seen a small sample before sending the order.

Record, p. 452, ans. 14, 15.

The oil thus ordered was not received till about Jan. 18, 1869, when it appears from the letter book of Seccomb, Kehew & Thayer that its receipt was acknowledged by telegraph and twenty barrels more ordered.

Ibid.

It is evident, however, from the prices paid for this oil that it was not Neutral Topaz.

Thayer testifies that they paid twenty-five cents for the first lot, fixing their own price, and for the second lot forty cents.

Record, p. 453.

Now this was no more than the common paraffine oils were selling for at this time, and Tweddle himself testifies that the price at which the Neutral Topaz Oil then sold was from seventy to eighty cents.

Page 216, ans. 228; p. 206, ans. 133.

Even if it be said that the first lot, being a sample lot, was sold under the market price, this would not account for the low price of the second lot, which was sold in the regular course of business.

While we still object to the admissibility of this testimony at the stage of the case at which it was offered, we submit that it is not of a character to overcome that offered by the complainant in rebuttal of the defendant's case.

Dr. Tweddle's claim that Neutral Topaz must be produced in distilling by superheated steam and a vacuum.

We have several times referred to Dr. Tweddle's statement in his direct examination, on p. 174, int. 142: "*By pursuing my process of distillation by superheated steam in vacuo, I can't produce anything else but Neutral Topaz Oil and burning oil.*" Upon the strength of this assertion it will be claimed, we presume, that as he did unquestionably use the superheated steam and a vacuum in 1867,

in his cast-iron still, he must of necessity have produced the distillate which, when the paraffine is expressed, is his Neutral Topaz Oil.

But this claim, that by the use of superheated steam and a vacuum, he must of necessity produce Neutral Topaz Oil, rests solely upon Dr. Tweddle's assertion. Not a single witness is called to support the statement. If the fact be so, it might easily be proved by experiment, and competent, disinterested witnesses could have been found to make the trial and testify to the result; and the failure to demonstrate what might be so easily demonstrated if it were true, renders it morally certain that the assertion is not true.

Dr. Tweddle's position is that, by the use of these agencies, steam and vacuum, crude petroleum cannot be decomposed, or to use the refiner's term, "*cracked*," into burning oil; that it can only be separated into light and heavy products, or into burning oil and lubricating oil; and that, therefore, his process of distilling with the use of a vacuum is, as his counsel puts it, in int. 206, p. 231, broadly distinguishable from the process of distilling by fire; or, as Dr. Tweddle himself puts it in his patent of 1870, his process is directly the reverse of a process which decomposes the petroleum into light or burning oil.

Dr. Tweddle also claimed that he purposed, when erecting his cast-iron still, to manufacture burning oils, lubricating oils, and paraffine.

Page 164, int. 78.

But even if it were true that no decomposition takes place in distilling *in vacuo*, it would not follow, as we have before observed, that the lubricating oil would *necessarily* be Neutral Topaz Oil, for there is no proof that the distillation by steam and vacuum necessarily removes the light oils, or spirituous bodies from the heavy oils, and this is essential to the production of Neutral Topaz.

But the claim, though supported only by the doctor's own testimony, made it necessary for the plaintiff to meet it by proof. 1st. That at least in the cast-iron still erected in 1867, it was possible

to carry on the cracking process. 2d. That such cracking did in fact take place in the use of that still.

To show that Dr. Tweddle originally purposed to resort to the cracking process, the plaintiff proved by experts that the cast-iron still had the very features and conditions which were usually resorted to to aid the cracking process, and which were enumerated in Dr. Tweddle's patent of 1870 as having been resorted to to ensure the cracking of the heavy oils. He proved that Dr. Tweddle claimed in 1867 that he could procure by his new process an amount of burning oil which in fact could be obtained only by the cracking process. He also proved by Dr. Tweddle himself that the cast-iron still had a high dome and a large vapor space.

Tweddle, p. 198, cross-int. 55; p. 226, cross-int. 336; p. 227, cross-ints. 344 to 348.

The plaintiffs also caused the still to be examined and found in it the deposit of carbonaceous matter which Dr. Tweddle, in his patent of 1870, said would result from the decomposition of petroleum.

Abbott, p. 347, ints. 52 to 56.
Atwood, p. 360, ints. 9 to 11.
Merrill, p. 430, ints. 48 to 53.

To meet this evidence that the cracking of oil could and did take place in the cast-iron still used with superheated steam and vacuum, the defendant obtained leave to reopen the case. Only one witness, however, besides Dr. Tweddle was called upon this point. This witness, Mr. Cuddy, testified (p. 456, ints. 24, 25) that in the cracking of oils "there is a deposit of hard coke always on the bottom of the stills at the close of each operation, and a deposit of a light porous substance in the stand pipe, and occasionally in the condensing pipes," and "that such deposit on the bottom of the still had to be removed after each run."

This removal, he says (ints. 26 to 28), was effected by picks and scrapers, leaving the marks of their use on the bottom of the still.

He then testifies (ints. 29 to 33) that he had recently examined the cast-iron still and found no such marks of the removal of coke. He also says that if crude petroleum of 43° gravity had been dis-

tilled in that still until 74 per cent of illuminating oil had been obtained by cracking, there would have been a deposit of coke, and that from his inspection he was of the opinion that no cracking had been practised in it.

He does not say whether or not 74 per cent of illuminating oil could be obtained from oil of 43° gravity, without cracking; but as he says, on cross-examination (p. 459, cross-int. 64), that with oil of 42° gravity, cracking would commence when about 60 per cent had been distilled off, it is certain that he must have believed that 74 per cent could be obtained only by cracking.

He also states (cross-int. 70) that he had never known refiners to draw off the residuum before any part of it had become solid.

Yet another witness called by the defence, Mr. Gracie, testifies that his firm cracks its oils, but there is no deposit of coke on the bottom of the still.

Page 488, cross-int. 17.

A quantity of this residuum Mr. Gracie had just sold to the plaintiff, who has produced a sample marked "Exhibit 131."

Page 488, int. 14.

Gracie says that 75 per cent of illuminating oil had been produced before reaching that residuum.

Page 489, cross-int. 22 to 27.

This evidence shows conclusively that the absence of the marks made by removing coke from the cast-iron still is no proof that cracking had not taken place in it.

Atwood, pp. 499, 562, ints. 5 to 23.
Merrill, pp. 511, 513, ints. 14 to 17.
Hayes, pp. 524, 525, ints. 3 to 10.

Dr. Tweddle (p. 716, int. 18), impliedly admits that the still did show evidences of cracking, but endeavors to attribute it to the effects of a fire to which the still was exposed in 1870.

But Dr. Hayes, Mr. Atwood, and Mr. Merrill have conclusively shown that this could not be so.

Atwood, p. 465, int. 26.
Merrill, p. 516, int. 30.
Hayes, p. 527, int. 15.

And if any doubt remained as to whether cracking could take place in distilling with superheated steam *in vacuo*, it was completely set at rest by an experiment or trial performed by the defendant's witness, Mr. Cuddy, at Dr. Tweddle's refinery on the 6th of June, 1872.

The details of this experiment are given by the witness on pp. 482 to 485.

Whatever may have been the object of the experiment, it conclusively proved that the cracking process, or the decomposition of heavy oils into light or burning oil, is effected in distilling by superheated steam and a vacuum in the same manner and under the same conditions as in distilling by fire alone, *i. e.*, by carrying on the distillation slowly.

This is fully proved by the testimony of Mr. Atwood (p. 504, int. 32 to cross-int. 44). of Mr. Merrill (pp. 504 to 516, ints. 18 to 29), and of Dr. Hayes (pp. 530 to 532, ints. 26 to 32).

This experiment was performed with a heavy petroleum, known as Franklin oil. Twenty-five barrels of this oil were placed in one of Dr. Tweddle's stills heated with superheated steam, in connection with a vacuum and twenty-five per cent of illuminating oil distilled off.

Cuddy, pages 482, 483, ints. 7 to 12, and page 484, cross-int. 35[1].

The oil remaining in the still was then transferred to another still, and fifty-five per cent of Neutral Topaz Oil distilled off by the use of superheated steam and a vacuum, leaving twenty per cent in the still as residuum.

Cuddy, page 483, ints. 13 to 20, and page 484, cross-ints. 31, 32.

Now, it is important to observe that the twenty-five per cent of illuminating oil was distilled off in three hours, or at the rate of about two barrels per hour, while the fifty-five per cent of Neutral Topaz Oil was distilled off in two hours and a half, or at the rate of about five and a half barrels per hour.

Cuddy, page 484, cross-ints. 35 to 38.
Merrill, page 514, int. 23.

This shows that the heat must have been applied to the oil much less rapidly when distilling the illuminating oil than when distilling the Neutral Topaz. It will be remembered that all the witnesses who have described the cracking process have stated that when, in the process of distilling, the stage is reached at which it is necessary to crack the oil, the fires are reduced and the distillation is carried on slowly to effect that result. The Franklin oil with which this experiment was tried being of a gravity of 32°, not more than ten per cent of illuminating oil can be distilled off before the point is reached at which cracking must be resorted to, and the cracking involves a slow distillation and a slow application of heat. And these conditions were involved in the production of the twenty-five per cent of illuminating oil.

Merrill, p. 514, int. 22.
Hayes, p. 554, ints. 27, 30.

Thus this experiment proves that cracking can be as readily effected in using steam and a vacuum as when using any other still, and that with any still it is the rate at which the distillation proceeds which will determine whether the oils will be cracked or not. If the cracking of oils were impossible by the use of superheated steam and vacuum, it would have been preposterous for Dr. Tweddle to claim, as he did in 1867, in his prospectus for a new company and in his newspaper articles, that he could produce a larger percentage of illuminating oil with his new apparatus and improved process than could be done by the ordinary process. He could not have believed what he then published, to induce others to invest their money in his improvements, if it were true that heavy oils could not be cracked or decomposed into light oils by his process of distilling by the aid of

superheated steam and a vacuum; but this experiment, proving conclusively that the cracking of oils can be effected in Dr. Tweddle's own stills, and by the use of superheated steam and vacuum, relieves him from the imputation that he falsely claimed, in 1867, that he could produce by his improved process more burning oil than by the old process, when he could not, in fact, produce so much, if the claim he now makes be true.

We submit that it is fully proved that the decomposition or cracking of oil takes place as well with superheated steam and vacuum as with ordinary fire distillation, and that the use of the former agencies does not necessarily produce Neutral Topaz Oil.

Alleged prior Invention by other Parties.

The original answer alleges that the invention was known and used, before its invention by Merrill, by George M. Gallop, of Salem, Mass., at said Salem, and at Brooklyn, N. Y.; by Eben Seccomb, of Boston, at said Salem, and by Edward S. Thayer, of said Salem, at that place.

No evidence whatever has been offered of any prior knowledge by Mr. Gallop.

Mr. Thayer has been examined as a witness in relation to the oils manufactured by the firm of Seccomb, Kehew & Thayer, of which he is a member. Mr. Seccomb, of this firm, may be the party mentioned in the answer, but this does not appear in the evidence.

Mr. Thayer does not claim that he has ever made oil like Merrill's; and as he admits that he bought Dr. Tweddle's Neutral Topaz to mix with his own oils (p. 453, cross-ints. 25, 30), it is pretty certain that they did not make it. More than this, Mr. Thayer says (p. 452, int. 18) that his partner, Mr. Kehew, showed him the first sample of Dr. Tweddle's oil, and told him that he (Mr. Thayer) was nowhere in manufacturing oil. It is safe to say that none of the parties named had any prior knowledge of the invention.

The last amendment to the answer contains an allegation of prior knowledge and use by William Atwood, of Portland, Maine. Long before this amendment was filed, Mr. Atwood had been examined as a witness on behalf of the plaintiff (pp. 25 to 41), and had pointed out (pp. 30 to 32, ints. 64 to 74, and p. 39, cross-int. 65) the essential differences between the patented oil and his own oil and the oil of other manufacturers. The defendants did not call Mr. Atwood, or any other witness, to prove that he had ever produced or seen an oil like Merrill's oil, prior to its production by Merrill. But the plaintiff having occasion to call Mr. Atwood again as a witness, interrogated him (p. 363) as to any claim he might have to be considered the inventor, as follows: —

"*Int.* 29. Have you ever examined Mr. Merrill's patent on which this suit is brought?

"*Ans.* I have.

"*Int.* 30. Did you ever make the invention described in it?

"*Ans.* I never did."

This disclaimer from such a witness as Mr. Atwood, coupled with the emphatic recognition which he gives throughout his testimony of the substantial difference between Merrill's oil and his own, ought to be conclusive that he at least derived his knowledge of the invention from Merrill.

In conclusion, we desire to recall to the attention of the Court, as of the utmost importance in considering the claims of Dr. Tweddle as a prior inventor, the following facts disclosed by the record: —

1st. Prior to the commencement of this litigation, Dr. Tweddle had publicly advertised to defend any persons who might be proceeded against for infringement of any Letters Patent of Joshua Merrill, and undertook to defend such suits and to guarantee the defendants against any costs or damages recovered, provided they placed their defence in the hands of the counsel who have acted for the respondents in this cause.

2d. The original answer in this suit was filed by counsel named in that advertisement on the 24th of May, 1870, two months after the filing of the Bill of Complaint, and after conference between Dr. Tweddle and his counsel. That answer contains no averment of prior invention by Dr. Tweddle, while it does contain averments of prior invention by other parties, thus evincing the fact that research had *then* been made into the state of the art to which the invention relates.

3d. On the third day of October, 1870, or five months afterwards, an amendment to that answer was filed by the same counsel, which amendment consists entirely of further allegations of prior invention of the patented article, but is wholly silent as to Dr. Tweddle's claims.

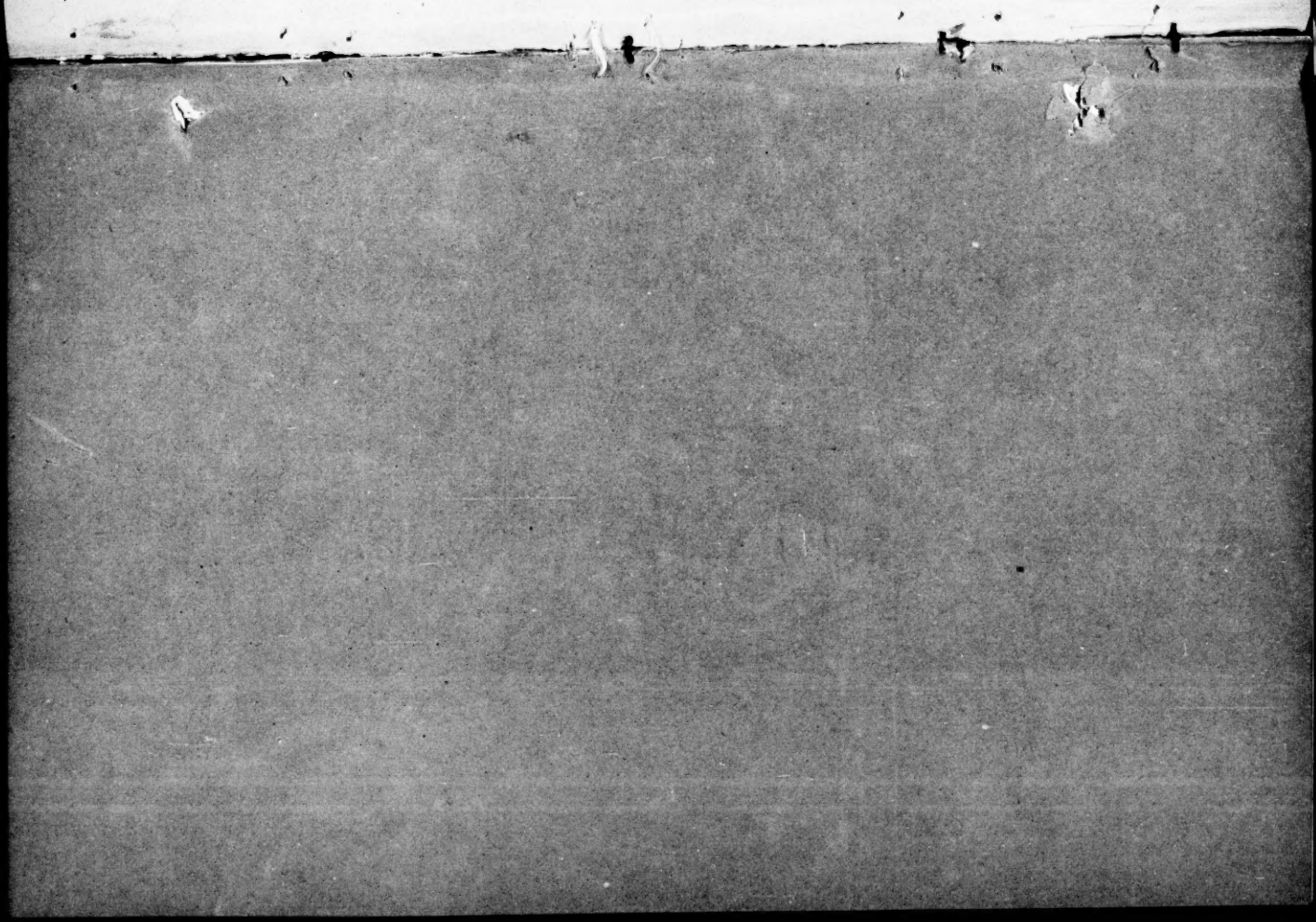
4th. The complainant began to take proofs in the cause on the 25th of October, 1870, and completed on the 17th of November following what will be seen to be a strong *prima facie* case in support of his bill.

5th. The respondent began to take proofs in answer to this case on the 18th of January, 1871, — that is to say, after two months' preparation, — and between the last-named date and the 25th of February following examined a very considerable number of witnesses, whose testimony cannot be regarded as of such a character as to overcome the case respondents had then to meet, or calculated to support, to any considerable degree, the averments of either of his answers, and certainly supported no allegations of prior invention; and it was under this aspect of his cause, and after the lapse of the full period of a year, that there is brought forward for the first time, and without any notice whatever, a claim which, if well founded, is decisive of this cause, the importance of which never could have been for a moment overlooked by counsel or client, and which must in its nature have lain as distinctly within the knowledge of Dr. Tweddle on the day he first had notice of this suit as on the day when it was finally set forth by him, — a defence which certainly would not have been concealed from his counsel, since his whole interest demanded its prompt disclosure to them, that they might avail themselves of it, and one that is based on Letters Patent which had been obtained for him by one of these very counsel themselves.

We submit, therefore, that this defence not only came in under such circumstances as to raise a strong presumption against its truth, but that the manner in which Dr. Tweddle himself has testified, and still more the manner in which he has refused to testify as to many important facts, the character and circumstances attending some of the witnesses he has produced, the unquestionable effort made to thwart the complainant's counsel in their efforts to investigate the history of his invention, and his failure to bring forward as witnesses those who must necessarily have had ample knowledge of the asserted facts, men with whom he was intimately connected in business, and whose standing and character in Pittsburg must have given great weight so their testimony, — not only throws great doubt upon all the evidence which he has produced, but renders it almost certain that he could not have made the invention, as he now claims to have done, and that his present position was an afterthought, brought forward as a last and desperate defence.

Add to all this that, though he says he was making, in the summer and fall of 1867, efforts to induce capitalists to engage with him in the manufacture of this very oil, and was certainly publishing the most glowing accounts of the value and importance of inventions which he had then made, and which he says were of such a character that they could not be used without producing the oil in controversy, there is no hint or suggestion in any of his numerous printed appeals to the public and to capitalists of *this* invention, or of his ability to produce any oil of *this* character, while, on the contrary, he set forth, as one of the great inducements for others to embark their money with him in the desired enterprise, that he could produce a much larger percentage of illuminating oil than by any other process, a percentage which it would be impossible for him to produce if Neutral Topaz was a part of the product, and which it was possible for him to produce if Neutral Topaz formed no part of the intended product; and we submit that it becomes morally impossible to believe in the truth of his present claim.

C. M. Reed
Chauncey Smith.
for Appellants



SUPREME COURT OF THE UNITED STATES.

No. 209.

JOSHUA MERRILL, APPELLANT,

vs.

DAVID M. YEOMANS AND DANIEL J. GOSS, AS D. M. YEOMANS & GOSS.

BRIEF FOR APPELLEES.

BRIEF.

The defendants are charged with infringement of *the first claim* of the Merrill patent, by *selling* certain oil known in the case as "neutral topaz oil."

This claim is as follows: —

"*I claim the above-described manufacture of deodorised heavy "hydro-carbon oils, suitable for lubricating and other purposes, free "from the characteristic odours of hydro-carbon oils, and having a "slight smell like fatty oil, from heavy hydro-carbon oils, by treat-"ing them substantially as hereinbefore described.*"

I.

This claim is for *a process*, not for *a product;* and the bill cannot be maintained against the defendants, who have no connexion with the manufacture, and only buy and sell the oil in the market, and are not charged in the bill as manufacturers.

That the patent is for a process, and not for a product, appears from the following language of the specification and claim.

The patent says, —

Page 7: "Have invented a new and improved manufacture of "deodorised heavy hydro-carbon oils, suitable for lubricating oils, or "for curriers' use; and I do hereby declare that the following is "a full and correct description *thereof*, and of *the mode of manufac-"ture*." This is the only equivocal clause in the specification. It may mean "a full and correct description of *my new oil*," or it may mean "a full and correct description of the deodorised heavy hydro-car-

"bon oils, &c., and of my *new process for making them*." We submit that it means the latter.

Page 8: "It is not practicable to specify particularly the specific "gravity of the heavy oils *used in* my new manufacture. These oils "are well known in the trade," &c. Now the well-known heavy offensive oils are not used in the patentee's deodorised oil; but they are used in *the process by which* that deodorised oil is produced.

Page 8: "*In carrying on my process I use the heavy hydro-* "*carbon oils*," &c. From this and the preceding reference, it is plain that the patentee uses "my new manufacture" and "my process" as synonymous.

Page 9: "In *carrying on* my new manufacture." His "new man- "ufacture," then, is a process. A product cannot be "carried on."

Page 10: "I do not wish to confine *my invention*" to the *use of* superheated steam in combination with the fire, the invention clearly consisting in *a process*.

Page 10: "*My invention consists in producing* heavy hydro- "carbon oils, suitable for lubricating and other purposes, and free "from the characteristic odours of heavy hydro-carbon oils, from "heavy hydro-carbon oils, *by distilling from them* the volatile mat- "ters," &c. The paragraph from which this quotation is made, excludes strictly the idea that the patented invention is *the heavy hydro-carbon oil*, suitable, &c., and free, &c., *itself*, as an article of manufacture.

> *Claim.* "I claim *the above-described new manufacture* of "deodorised heavy hydro-carbon oils, suitable for lubricating "and other purposes, free from the characteristic odours of "hydro-carbon oils, and having a slight smell like fatty oils, "from heavy hydro-carbon oils, *by treating them substantially* "*as hereinbefore described*."

It has been held that a claim to "the said manufacture of printing

"type *made* substantially as described, viz., *by* the combined pro-"cesses," &c., &c., was a claim not for the product, but for the means by which it was produced. *A fortiori*, this patent must be construed as for a process, not for a product.

Hudson *v.* Draper, 4 Fisher, 256.

II.

Even if (as is not the case here) the product were new and patentable, yet, the patent being for the process, it would not be infringed by selling the product.

Curtis on Patents, §§ 313, 314.

The contrary was held by *Grier*, J., in Goodyear *v.* The Railroad, 2 Wallace, Jr., 356. The claim was "*curing* caoutchouc," &c., "*by* "*subjecting* it," &c. The defendants were sued for using the vulcanised rubber in car springs; and one of their defences was that the patent was for a *process*, not for a *product*, and that they had not used the process. The court nevertheless decreed an injunction, saying (page 365), "The product and process being both new and "proper subjects of a patent, the patentee has the right to prohibit "the sale or use of the composition," &c.

Afterwards, before *Nelson*, J., Goodyear *v.* Wait, 3 Fisher, 244, this case of Goodyear *v.* The Railroad was cited; and it was argued that if a patent for the process was virtually a patent for the product, *e converso*, a patent for the product was virtually a patent for the process, and that therefore the re-issue which Goodyear had by that time taken, in two divisions, one for the process and the other for the product, was void, the validity of either claim excluding the validity of the other. Judge Nelson, after quoting the claim in the original patent, which was before Judge Grier, and adding, "A claim, "we are strongly inclined to think, for a process, instead of the pro-"duct," proceeds to say that he considers the patentee entitled to the two claims, one for process and the other for product; and then remarks, "*As it respects the decision in Goodyear* v. *The Railroad, we* "*have reason to know that Judge Grier felt considerable embarrass-*

"*ment in making it, and from which he would have been relieved if* "*there had been a claim for the product or substance.*"

Judge Grier cites, in support of his decision, the case of Hancock *v.* Somerville, in the English Court of Common Pleas (which the reporter says, in the margin, was "tried" in June, 1851; it was therefore probably at *nisi prius*). The case is not, we believe, in any of the reports. As stated by Judge Grier, the claim was "the "treating of caoutchouc with sulphur . . . when acted upon by heat, "and thus changing the character of caoutchouc, herein described;" and it was ruled that the sale of articles made of caoutchouc so treated was an infringement.

We do not know enough of the facts in that case, nor of its history, to determine its value as a judicial decision. But the case, if accurately reported, is of no authority here; because the English law allows a patent for "any manner of new manufactures;" a term which includes process and product (Carpmael on Patents, page 13); whereas our law distinguishes between a patent for a process (viz., an "art") and a patent for an article of manufacture.

Clifford, J., in Goodyear *v.* Providence Rubber Company, 2 Cliff. 371, says, "No doubt can be entertained that a new product or "manufacture, and a new process or method of producing the new "article, are the proper subject of *separate and distinct claims* in an "original patent."

This bill cannot, then, be maintained unless the first claim of the Merrill patent be held to be for a product or article of manufacture, and *not* for a process. It cannot under our law validly be for both.

III.

The *product* is not patentable, because it does not differ in any patentable respect from several pre-existing paraffine oils (other than the Tweddle oil) which were extensively sold in this country for lubricating purposes before the date of Merrill's invention. The difference is one of *degree* only.

The really material qualities of Merrill's oil, its body and its odour, are due to the fact that *it contains a comparatively heavy grade of thin oils.* The better qualities of paraffine oils were also comparatively free from those oils. They differed in this respect among themselves and from his; but with them all, including his, it is merely *a question of the grade of the thin oils which are present.*

These thin oils are convertible into vapour at lower temperatures than the residue of the oil, and the vapours are inflammable. Depo. of *Horsford*, page 470, ans. 2.

They extend through different degrees of gravity. If a given paraffine oil contain *the lightest* of them, they will vaporise more or less at ordinary temperatures, and give out a strong smell. If a second paraffine oil contain no thin oil as light as the first oil contained, it will vaporise less readily at ordinary temperatures, and will give out a comparatively faint smell of the same kind. And so if a third oil contain no thin oils as light as the second did, it will vaporise but slightly at ordinary temperatures, and an obtuse or uneducated sense will perceive no smell at all; but still the thin oil is there, and it needs only a more acute or more educated sense to perceive it at ordinary temperatures, or a higher temperature to make it perceptible by everybody.

The question of novelty or peculiarity of the oil must depend upon the fact of *its chemical constitution;* and herein, as regards the thin oils, to the removal of which Merrill's invention relates, his oil differs from several of its predecessors in the market, *only in degree;* viz., in *the gravity of the thin oils which it contains.* (See particularly *Atwood*, pp. 38, 39, ans. 54–59, 68, 75–77, 69–72.)

Professor Horsford experimented (see pages 306, 307) with a series of paraffine oils, including Merrill's and four of the best of its predecessors, to ascertain the temperature at which the thin oils present would volatilise so as to be inflamed, and consequently the gravity of the thin oils which each contained. The result was as follows: —

Seccomb, Kehew and Thayer oil . .	248° F.
Maysville summer oil	257° F.
Lincoln oil	275° F.

Coffin medium oil	285° F.
Merrill deodorised oil . . .	295° F.

The paraffine oils produced before Merrill's or Tweddle's oil differed very much among themselves in quality as to odour and body, depending somewhat on the character of the stock, and more upon the care and skill used in the manufacture.

In some cases, to get a superior quality, the paraffine oil, after treating with chemicals, was distilled over a second time. The Downer Company's oil, before Merrill's invention, was sometimes so made (page 58). So was the Coffin oil (page 111).

It is also to be noted that from the time of the first introduction of paraffine oils there was a gradual improvement going on in their character, as to body, colour and odour. *Yeomans*, page 106, ans. 26.

Seeing that the product described in the Merrill patent is a heavy hydro-carbon oil from which the thin oils have been removed, and that, as the foregoing experiment shews, they are not *wholly* removed in the Merrill oil, but only removed to a greater *degree* than in earlier oils, we submit that the patent, as a patent for a product, cannot stand upon this difference of degree, and that the questions raised in the evidence whether or not, by virtue of this difference in degree, the Merrill oil is better, or commands a higher price, are immaterial. But as the court may judge otherwise, we have placed in an appendix to this brief a discussion of those questions, not wishing to obscure the course of the argument by inserting that discussion here.

It has been suggested by the plaintiff, that various oils recognised in the market as different oils are not more sharply distinguished from one another than is Merrill's oil from some of the earlier paraffine oils. That may be true. But commercial classification is one thing, and legal classification is another. In many trades, variations in degree of weight or fineness or some other quality of the article, make what *the trade* calls different articles, and to which *the trade* gives different names. And any witness taken from the trade would swear properly enough that a such a variation made an article *a new article*. But that does not meet the question whether it is new *in*

law as being *substantially* different from the old articles, *i.e.*, different in some patentable respect.

IV.

If the claim is for a *product*, it is for a product made by the process substantially as described in the patent.

The claim can only be construed to be for a product or article of manufacture at all, by reading it thus.: "The above-described new "manufacture of deodorised heavy hydro-carbon oils . . . [*produced*] "by treating them [heavy hydro-carbon oils] substantially as herein- "before described." We object to this reading as repugnant to the rest of the paper, as before shewn, but accept it here for argument.

> In the case of Goodyear Dental Vulcanite Company *v.* Gardner, decided by Clifford and Bullock, JJ., on motion for interlocutory injunction in 1868, the claim was, "*The plate* of "hard rubber or vulcanite, or its equivalent, for holding artifi- "cial teeth or teeth and gums, substantially as described."
>
> The court held that the patented invention was "a product "and manufacture by the means described in the specification;" thus interpolating, for purposes of construction, the word *produced* before words "substantially as described." There was nothing in the preceding description repugnant to this.
>
> The suit in that case was against a dentist who made *the described plate by the described process.*
>
> It has always been considered since, that the patent could not be invalidated except by shewing a similar plate produced by *a similar process* previously, and was not infringed except by shewing the same thing done subsequently.

We are now assuming (for argument) that the product, the oil, is *an essentially new article;* for if is not, of course the patent *can* only be for the process for making it.

And assuming the product to be an essentially new article, it is at

least questionable as matter of law, whether there can be a patent for *a new article however made*.

> In Woodward *v.* Morrison, 1 Holmes, 124, it was said, "Regarding the invention or subject matter of the complain- "ants' patent as an entirely new manufacture, it might, *per- "haps*, be sufficient to this case to find, what the evidence we "think discloses, that the defendants make substantially the "same thing, whether by the same or a different process."
>
> And in the case of Goodyear *v.* The Railroad, 2 Wallace, Jr. (before referred to), *Grier*, J., said (page 361), that if, for example, *steel* as a substance was new, it could be patented as a product, and no person "could, by varying or im- "proving the mode or process of its production, rob the paten- "tee of his franchise."
>
> On the other hand, it was argued for the plaintiff in the case of Goodyear Dental Vulcanite Co. *v.* Gardner, and the argument apparently was accepted by the court, that "in "general, it is true of a claim of a manufacture, that what is "covered is not merely an article such as is here described, "but an article produced substantially in the manner de- "scribed."

It is sufficient for us, however, to maintain, that in the case at bar, the patent, if for *an oil* at all, is for an oil produced by the process described; that being the extremest latitude that can be given to the construction of the claim.

IV.

The process described in the Merrill patent consists in taking a certain known kind of oil which is *a distillate*, and which by reason of being a distillate had become infected with certain offensive thin oils, and removing those oils by fractional distillation, leaving the so-called Merrill deodorised oil as a residuum in the still.

The patent says,—

Page 7: "My invention relates to the heavy hydro-carbon "oils which have been produced *by distilling* crude petro- "leum . . . and other substances producing hydro-carbon "oils *by distillation*." "It has been the practice to treat such "heavy oils with acids and alkalies, for the purpose of remov- "ing the disgusting odour peculiar to these oils." All the evidence in the case shews that the heavy oils which have been so treated, were *distillates*. "I take the heavy oils "which have been separated from the lighter oils, and from "mechanical impurities, *by distillation*," &c.

Page 9: "I do not assume to know the reason why "the above-described process produces heavy oils free from "the characteristic odours of hydro-carbon oils, but *suppose* "*that these odours arise* from matters resulting from decompo- "sition at the temperature at which *the heavy oils vaporise* "*and go over;* and that these matters, after they are condensed "with the heavy oils, will vaporise at a temperature lower "than that required to vaporise and distil over the heavy oils, "and therefore may be separated from the heavy oils by distil- "lation in a close still, at a temperature below that required to "distil over the heavy oil, which, not being vaporised, will "remain free from the odorous matters which would result "from decomposition at the temperature required to vaporise "it and distil it over."

Page 10: "My invention consists in producing heavy hy- "dro-carbon oils suitable," &c., "from heavy hydro-carbon "oils, *by distilling from them the volatile matters from which* "*the objectionable odours arise*, and at the same time pre- "venting new formations of such matters by keeping the "temperature of the oil in the still below that at which these "matters form by decomposition of the oil."

From the foregoing passages, it clearly appears that *the process* of Merrill consists in taking the heavy hydro-carbon oil, which is itself a distillate, and which, in the course of its distillation, and by reason

of the decomposition resulting from the high temperature which had been required for that distillation, had come to contain certain offensive volatile oils, and *removing* those volatile oils by distilling them off, by the use of a temperature high enough for that purpose but not high enough to decompose any of the heavy oil in the still and produce *more* of the volatile oils.

It involves *two essential features;* first, the material to be subjected to the process is a heavy oil possessing volatile oils which have been produced in it *by its previous vaporisation at a decomposing temperature;* secondly, the process to which it is subjected is that of *distilling off the volatile oils and leaving the deodorised oil as a residuum in the still.*

This was what Merrill did in fact in making his alleged invention. (Pages 51, 52.)

And he does not appear to have ever made the oil in any other way, except for experiment, after the defendant's oil had long been manufactured.

His specification throughout assumes that heavy hydro-carbon oils, suitable for lubrication, had been made, and only made, as *distillates*, by a distillation conducted at a temperature so high as to decompose the vapours and generate offensive light oils which were condensed with the distillate.

He himself had so made them, for the Downer Company, for years. He had never made them in any other way. Various other manufacturers in different parts of the country had been engaged in making them in the same way. They were a well-known article of commerce, designated by the general term "paraffine oils."

His process is clearly a process of *removing* from these well-known oils the light oils which are generated in them as distillates, and because they are distillates; there being in the contemplation of the patent no way of making heavy hydro-carbon oils suitable for lubrication except as distillates, and consequently no way then known of making them without generation of thin offensive oils.

That was (except in the case of Dr. Tweddle) the universal way of making them; and it was the evil inherent in them, as made by that common and familiar mode, that Merrill intended to remedy by

removing from the oils so made the offensive thin oils which existed in them in greater or less degree.

It was known that such offensive thin oils did so exist in the heavy hydro-carbon oil (distillate), and various attempts had been made so to modify the distillation by which they were obtained that they should not have the offensive thin oils generated in them; which attempts were more or less, but not wholly, successful. (Merrill had tried this, page 87, and Atwood, page 44, ans. 64.) In other words, the effort had been to get a heavy distillate which did not contain the offensive thin oils.

Merrill *accepted the conclusion* that a heavy distillate could not be made which did not contain offensive thin oils, and he invented a way of *removing them*.

V.

The process of Tweddle, by which the neutral topaz oil sold by the defendants, was made, is as follows: —

Crude petroleum, having been first deprived of its lighter ingredients, such as gasoline, benzine, &c., by steam distillation or otherwise, is admitted into a vacuum still, into which steam is introduced, and a moderate fire heat maintained outside if desired. Distillation then proceeds until the illuminating oil has all been distilled over; the distillate at that point marking about 38° B. What remains in the still, instead of being distilled over in such a way as to produce decomposition, and consequently offensive light oils (to which distillate the Merrill process is applied, and from which it removes the offensive light oils by a second distillation), is distilled over in such a way that practically no decomposition takes place, practically no offensive light oils are produced, and the distillate requires no further distillation or treatment, except, perhaps, the light chemical treatment common to all paraffine oil manufacture; frequently, not even that. (Depo. of Tweddle, pages 169, 175; ans. 114, 153; patent of Tweddle, pages 446, 447.)

The process of Tweddle differs from that of Merrill in the following marked particulars: —

The distillations effected in the two cases are different.

Tweddle reaches by *one* distillation the result of neutral topaz oil, and that distillation he conducts and must conduct in vacuum, in order to avoid the high heat which generates the thin offensive oils, because, *so far as they are generated at all, he leaves them where they are.*

Merrill reaches the result of the deodorised oil by *two* distillations. The first is a distillation at such high temperature as to generate the thin offensive oils; and the second is at such a lower temperature as will vaporise and remove them by fractional distillation, without generating any more of them. The use of vacuum is excluded in the former process, and is immaterial in the latter.

In the single process of Tweddle it is absolutely vital.

The object or purpose of Merrill's process is radically different from that of Tweddle's process.

The distinction between his process and that of Dr. Tweddle is recognised by Merrill himself in his reply to cross 53 (p. 521,) where he speaks of the formation of "these thin oils, the *removal* of "which or the *absence* of which leaves an oil commercially deodor-"ised."

Now here is the difference between *prevention* and *cure*. Tweddle *prevents* the offensive odours. Merrill *cures* them, with considerable waste, of course.

The fact is, that Merrill did not know or believe, when he took his patent, that it was *possible* to produce heavy hydro-carbon oil, practically and commercially, except by the use of high temperatures, involving decomposition and the production of thin offensive oils; his patent everywhere shews that he did not; it assumes that all heavy hydro-carbon lubricating oil is produced in that way, and contains those oils, and that the disgusting odour is one of their peculiar characteristics; he himself tried to produce them, with the use of steam in connection with fire, so that they should not contain

those oils, *and failed*. (See p. 59, ans. 32.) He cannot be permitted to hold as an infringement a process for preventing the creation of the evil which his invention assumed that it was impossible to *prevent*, and which, therefore, it undertook to *cure*.

We now ask the attention of the court to the language of Judge Shepley in his opinion, comparing Tweddle's process with Merrill's. He says, —

"It is clear that the process is essentially different from that described in Merrill's patent. The very essence of Merrill's invention "was the elimination of offensive odours existing in distillates, the product of a destructive distillation. It was a deodorising process, "consisting in the removal by distillation of the light offensive oils "produced in the oil by previous distillations, leaving a sweet residuum in the still. This product was a deodorised oil, an oil disinfected, an oil described by him as completely divested of its fetid "and pungent odours. Tweddle does not make his oil from a "distillate made offensive by the presence of the products of distillation, but directly from crude petroleum. His process is not a "deodorising or disinfecting process to remove the odorous bodies "that had been formed by or existed after distillation. It is designed "to so conduct the distillation as to leave the distillate of crude petroleum free from those odorous bodies. Tweddle's has been well described as a process of prevention, while Merrill's is one of cure. In "the two processes, Merrill's deodorised oil is a residuum left in "the still; Tweddle's neutral topaz oil is a distillate which passes over "and is condensed, and falls into the receiver. Tweddle's process is "conducted *in vacuo;* Merrill's under atmospheric pressure. Other "differences are apparent, upon examination of the different processes, as described in the respective patents, and as described by "the expert witnesses. Sufficient has already been said to shew "that the differences in the two processes are so radical that Tweddle's "neutral topaz oil cannot, with justice, be claimed to be a deodorised "heavy hyrdo-carbon oil manufactured from heavy hydro-carbon "oils, by treating them substantially as described in Merrill's patent.

"Therefore the use and sale of it by the defendants was not an in-
"fringement of the first claim in the Merrill patent."

It is not entirely clear how the plaintiffs undertake to maintain their allegation of infringement in the face of such radical differences between the two processes.

They have argued below, and will probably argue here, that the Merrill specification contemplates certain variations from the exact process described, and therefore (such must be the argument) the widest variations *may* be embraced by it. But the variations mentioned in the specification are strictly *inside of the line* by which Judge Shepley's opinion rightly circumscribes the Merrill process. They are all variations in the way of removing the offensive thin oils by fractional distillation from a heavy hydro-carbon oil, itself the product of a previous distillation, and which, by reason of such distillation and the necessary high temperature, had undergone a certain decomposition yielding such thin offensive oils.

Thus the patentee suggests the use of steam, or superheated steam, in aid of the heat by which he distils off fractionally the offensive thin oils. But this variation is obviously unimportant to the question which we made between the two processes.

Again the patentee has, in his specification, a passage of which a misleading use has been made, and may be made here. It is on page 10, and is as follows :—

"It will also be evident to those skilled in the art, that my inven-
"tion will be used if the above-mentioned process be worked to pro-
"duce the deodorised heavy oils above described, from *distilled*
"hydro-carbon oils, from which the lighter burning oils and naphthas
"have *not* been separated, so long as they contain heavy oils, because
"the naphtha and lighter oils will go over first, *leaving the heavy oil*
"*in the still to be operated upon;* and also because, as before stated,

"*the distilled heavy oils always contain more or less of the lighter* "*bodies*, owing to the making up of a portion of the heavy crude oil "in the process of distillation."

But this is evidently the same process of removing the offensive thin oils by fractional distillation from a heavy oil, the product of distillation, which became infected with thin oils by reason of the high temperature at which it was distilled.

Dr. Hayes says (p. 76. ans. 25), speaking of this paragraph in Merrill's patent,—

> "The material so described *must be a distillate* from petro- "leum, from which the tarry matter and separated carbon have "been removed. It may or may not contain paraffine. It cer- "tainly contains light, odorous oil; but is free from tarry mat- "ter or separated carbon. *It differs in this respect from crude* "*petroleum*, which contains tarry matter, and from common "distilled heavy hydro-carbon oils, which do not contain so "large a proportion of light oils."

Dr. Tweddle agrees with Dr. Hayes as to what the clause in question in Merrill's patent refers. He says (page 175, ans. 152),—

> "I understand him to mean that he takes or can take the "distillate of crude petroleum, where the light burning oils, "the naphthas and heavy oils, have all been distilled over "and are mixed together. He takes this distillate and distils "over the naphtha and the burning oil; the residuum in the "still he then subjects to the distillation by steam or super- "heated steam and fire, distilling off the offensive oils, until "he is satisfied, I suppose, that the residuum remaining in "the still is what he requires."

Dr. Hayes says (p. 80, cross 15),—

> "The material which Merrill operates upon is one that "*has been distilled. In this previous distillation odorous* "*bodies have been formed*, or certainly are present, *and he* "*removes them* from his deodorised heavy oil, *the tarry mat-*

"*ters and separated carbon having been removed by the* "*previous distillation* mentioned and referred to in speaking "of the previous distillation. I consider that Merrill's de- "scription *involves the previous separation of tarry matters* "*and separated carbon.*"

This clearly means that Merrill's process consists in *removing* from oil which has been once distilled, and which in that distillation had left behind it the tarry matter and separated carbon, *the odorous bodies that had been formed in that distillation;* and it is immaterial, of course, as Merrill justly says in his patent, that the process of removing these odorous bodies (which reside in the heavy portion of the oil) is applied to "distilled hydro-carbon oils from which the "lighter burning oils and naphthas have not been separated, so long "as they contain heavy oils, because the naphthas and lighter oils will "go over first, leaving the heavy oil [that which contains the odorous "bodies] in the still to be operated upon."

The plaintiff has also attempted to argue that really his oil is a distillate, as well as Tweddle's, and not a residuum. But the answer of Merrill (p. 422, ans. 29) in which this attempt is made, consists in — we think it fair to say — a mere juggle with words.

He says, "My oil is in all cases a distillate;" "the oil made by "Dr. Tweddle is also a distillate." But it turns out that he means just what we say, that the oil *from which he makes his oil* is a distillate. Whereas the oil of Dr. Tweddle and the defendants, the "neutral topaz oil," is a distillate, Merrill's "deodorised oil" being a residuum.

Merrill takes his stock (or the distilled oil from which he makes his deodorised oil), places it in a still and does not distil *it* over at all, but distils over *from it* the offensive thin oils which produce the disgusting smell. His deodorised oil remains in the still, and is *the residuum* of his process.

Tweddle, on the contrary, puts crude petroleum into his still; first distils over the naphthas and burning oils, and then the heavy or

neutral topaz oil, which passes through the condenser, and is found as a *distillate* in the receiver.

Thus, then, although derived from crude petroleum as its original source, and *made from a distillate*, Merrill's oil is itself a *residuum;* that is, it is not vaporised to remove the thin offensive oils, but the thin oils are distilled from it.

In the very answer in which Merrill endeavours to shew that his oil is a distillate, he confesses to the contrary. He says, —

> "In order to produce my oil, the petroleum *from which it is* "*derived* must be distilled over in order to separate from it the "tarry and coky matters which are developed in the process of "distillation," &c.

In other words, his oil is *derived from* a distillate, and is itself a residuum. Tweddle's is derived from a residuum, and is itself a distillate.

Merrill applies his process to a *distillate* having in it thin offensive oils, and by his process removes them. Tweddle applies his to a residuum having in it no thin offensive oils, and by his process avoids producing them.

Merrill distils at a temperature which must be low enough to leave the sweet oil behind in the still. Tweddle distils at a low temperature, which, owing to the use of a vacuum, carries over sweet oil to the condenser.

Merrill's process implies the existence of these thin offensive oils in the oil to be treated, and proceeds to remove them by vaporisation.

Tweddle's process is the reverse of all this. He commences with crude petroleum and distils it once only. His neutral topaz oil is made in one process with all his other products, and is only one division of the fractional distillation.

He distils his oil by means of vacuum and steam, so as (*he says*) to generate none of the offensive vapours or oils which are produced by fire distillation; at any rate, whether they are there or not, they are not present in such quantity as to make his oil offensive. His oil is a distillate only, and not a residuum of a distillate.

The plaintiff also contends that in each process, his and Dr. Tweddle's, the same steps are taken in each, and that the only difference is in the order in which they are taken; Merrill vaporising his heavy oil and separating it from the tarry residuum near the beginning of his process, while Tweddle does it near the close.

Now there are only four things to be done, in order to make paraffine lubricating oil ready for use at all seasons of the year. (1) separate the naphthas and burning oils from the crude petroleum; (2) separate the tar and other impurities; (3) separate the paraffine; (4) separate the offensive thin oils. If, then, Merrill's patent covers doing these things, *in whatever order*, it covers any and all ways or processes of making the lubricating oil.

But it is not true that the same steps are taken in any order by Tweddle that are taken by Merrill. One of the four things which Merrill does is to remove the offensive thin oils by distillation from the desired heavy oil. This is never done by Tweddle. There are no offensive thin oils removed by distillation; there are no offensive thin oils removed at all.

The plaintiff says, that the last distillate which passes over in Tweddle's process contains offensive oils, and that there *must* be some such oils left in his residuum.

This, if true, does not help the plaintiff. If Tweddle's process leaves offensive thin oils *in* his residuum, and then (as is the fact) he raises that residuum — offensive thin oils and all — in vapour and condenses it all in the condenser, that certainly is not a process of *removing* offensive thin oils.

The plaintiff at the hearing below argued, in support of his claim, that the two processes are substantially the same; that "both depend "upon a knowledge of the fact, first made known to the public in "Merrill's patent, that the odour of paraffine oils was due to light "volatile oils associated with them; and both carry out this principle "by a process of fractional distillation for the purpose of separating "these oils."

It is true that both depend upon a knowledge of the fact that the odour of paraffine oils is due to light volatile oils associated with them, and it might safely be conceded (against the evidence) that this fact was first made known to the public in Merrill's patent. But these things do not help the plaintiff's case.

Even if Merrill was the first to make this discovery as to the cause of the odours, that would not entitle him to monopolise all ways of producing oil free from the odours. He cannot patent the discovery (if it were his) of the true constitution of the old paraffine distillate. Nor can he have a patent to cover, as substantially the same, a process of removing the offensive oils from that distillate, and a process of producing a distillate from which they do not need to be, and are not, removed.

The rule of law in question goes no further than this: that the discoverer of the new principle is entitled to cover all means of performing upon the material *the operation* necessary to make the principle available. Upon this doctrine the discovery that the characteristic smell of heavy hydro-carbons was the smell of associated thin oils, might entitle the discoverer to monopolise all means of *removing* those oils. But it would be a very different thing to say that it would entitle him to monopolise all ways of producing a heavy hydro-carbon oil which had no associated thin oils. That would be, exactly, to give him a patent for a result.

As to the allegation that both Tweddle and Merrill carry out this "principle," viz., the fact that the odour of paraffine oils is due to light volatile oils associated with them, "by a process of fractional distil-"lation for the purpose of separating these oils," we cannot understand upon what evidence, or even assumption of fact, it is based. Nothing can be more certain than that while Merrill removes these offensive thin oils by fractional distillation from heavy hydro-carbon oil, Tweddle so produces heavy hydro-carbon oil as not to have any offensive thin oils at all, or, if any, so little that he does not need to and never does remove them.

VI.

But apart from the substantial differences between Merrill's process and Tweddle's, the oils themselves are substantially different.

Tweddle's oil is not free from odour.

Merrill's claim, if for an oil at all (as distinguished from a process), is for an oil "free from the characteristic odours of hydro-carbon "oils, and having a slight smell like fatty oils."

He says, in his testimony, "Since my discovery I know I can "manufacture a heavy hydro-carbon oil as free from odour and taste as "paraffine wax itself, and paraffine is as odourless as granite."

Such an oil, then (1), absolutely free from the characteristic odour of hydro-carbon oil, and (2) having a slight smell like fatty oil, is what the patent calls for, and what the patentee admits he can produce.

Such an oil the defendants have not sold, and Tweddle has not yet made.

If Merrill's oil is permitted to have any hydro-carbon oil smell, under his claim, then the question is, how much smell? How is the amount of smell to be measured? What is the standard? There is no measure of smell, as there is of gravity and heat. If the patent be for an odourless oil, however made, that is, irrespective of the process, then Merrill has no patent for a *process* at all, and any one may use his method of deodorising oil, provided he leaves enough smell in it to be below the standard which is fixed by the court; for the patent fixes no standard other than that of freedom from the characteristic odour of heavy hydro-carbon oils. If a man has a patent for absolute alcohol, would it be infringed by an alcohol which had one, two or three per cent of water in it? The utter impossibility of fixing the amount of smell an oil must have to be free from infringing this patent, settles the question, as we submit, that nothing but an odourless oil, so far as hydro-carbon odour is concerned, is an infringement; and if so, the question is easily tested by one who has an accurate sense of smell.

But our oil is not in fact the same as Merrill's, —

1. Because it is not free from odour.
2. And has a different gravity.
3. And a different boiling point.
4. And a different degree of viscidity.
5. And is not a deodorised oil.

As to odour.

Tweddle does not claim that his neutral topaz oil is absolutely free from offensive odour. The difference in this respect between his oil and Merrill's is due, no doubt, to the difference of the processes by which they are made.

Merrill takes an oil having a large amount of thin offensive oils, and removes them from the body of the oil by a special distillation. Tweddle, on the other hand, has no process of deodorisation, and any thin oils which may happen to be generated pass over to the distillate and would be found in it.

That such is the case is proved by the testimony of one of complainant's experts, *Mr. Atwood*, who made experiments in distilling the Merrill oil and the Tweddle oil and the Portland oil, ascertaining the amount of volatile oils (which are the source of offensive odours) that was in each. He obtained from Merrill's $\frac{5}{10}$ of 1 per cent; from Tweddle's 4 per cent; and from the Portland oil $4\frac{1}{10}$ per cent. The patent, if for the result, deodorised oil (deodorised by the removal, or odourless by the absence, of the thin offensive oils), cannot be construed to include such a difference as thus appears between Merrill's and Tweddle's oil, without being void for want of novelty in view of the Portland oil. (Depo. of *Atwood*, page 356, ans. 10, 14; page 368, ans. 33.)

The presence of this amount of thin oil in Tweddle's oil, as compared with Merrill's, not only proves it to be a different oil from Merrill's, and accounts for it not being so free from odour, but it affords further evidence as to the substantial difference between the processes employed by Merrill and Tweddle, respectively.

As to gravity and boiling point.

It is true that Merrill neither states in his specification, nor claims in his patent, any precise gravity or boiling point for his oil; but in relation to the identity or difference of two oils which are compounds of the same elements and derived from the same crude material, there should be some such statement or some other equally feasible way of testing the question by physical qualities. All hydro-carbon distillates are very similar; and below the gravity at which they are suitable for lubricating purposes the similarity is yet more close. The difference, if any, will be slight, but it is only in these respects that there can be any difference; and this difference makes a different oil, if such a thing be possible (for it is only a question of degree); but if it be not possible, then Merrill's patent falls at once.

The greatest disparity between these oils (Merrill's and Tweddle's) is in the gravity, and this is a difference on which we can base a difference of physical constitution. It is probably partly owing to the presence of some thin oils just alluded to.

S. Dana Hayes tells us (p. 75, ans. 21),—

"Both of these oils (Merrill's and Tweddle's) are lighter in den-
"sity than others in the market, and they both boil at higher temper-
"atures than others in the market. The oil made at the Downer
"Kerosene Oil Works [Merrill's] has a density of 29 ⁸ Beaumé.
"The sample from the barrel [Tweddle's] has a density of 34 ⁸
"Beaumé. The boiling point of Merrill's oil, as made at the works,
"is 600° Fahrenheit; the boiling point of the oil from the barrel
"[Tweddle's] is 585° Fahrenheit."

Now here is a marked difference of physical characteristic, arising, doubtless, from the great difference existing in the mode of manufacture. As Merrill tells us (p. 67, ans. 43, 44), it is a difference of carbonisation, or a difference of arrangement of the elements (hydrogen and carbon), taking place during the process of distillation.

The difference is, that Merrill's oil is 5° Beaumé heavier than Tweddle's.

The boiling point of Merrill's is 15° Fahrenheit higher than Tweddle's.

Reduced to weight, which is more intelligible, perhaps, than degress of Beaumé, Merrill's oil, $29\frac{}{10}$° Beaumé, would weigh 7 lbs. 5 oz. per gallon; Tweddle's oil, $34\frac{8}{10}$° Beaumé, would weigh 7 lbs. per gallon; so that a barrel of oil containing 40 gallons of Merrill's oil would weigh a little over 12 lbs. more than a barrel of Tweddle's. This difference is, of course, owing to the fact that Merrill's oil is richer in carbon than Tweddle's, and Tweddle's is richer in hydrogen than Merrill's.

As to viscidity.

Another difference in physical properties is shewn to exist between these two oils, by the test appplied to them by Merrill. See Record, p. 54. He says, "It [Tweddle's oil] weighed 18°, McNaught's "test, when the ordinary paraffine oils weighed much less, my own "oils testing by that instrument 22°."

Here we have a difference in viscidity or body; so that in all these respects, odour, gravity, viscidity and boiling point, these oils are not identical, but differ in degree, just as all the refined paraffine lubricating oils are proved to do.

It is not a deodorised oil.

The distinction between an oil which is made originally free from the disgusting odour which is stated to be a peculiar characteristic of the class of oils to which it belongs, and an oil of the same class which, having had this disgusting odour, has been subjected to a special process for the purpose of ridding it of that odour, is certainly not a fanciful one, but has a sound basis.

This is a distinction recognised by the complainant when he speaks, in his reply to cross 53 (page 521), of the *absence* of these offensive oils, or the *removal* of them.

And it is in this sense that the word deodorised is always employed. Worcester defines deodorise, "to deprive of odour, to dis-

"infect." If any article is spoken of as being deodorised, the idea is at once suggested that at one time it had a bad smell which has been in some way removed. Pure spring water is odourless, but is not deodorised; while, on the other hand, there are many mineral waters which, having naturally an offensive odour, would be properly styled "deodorised mineral water," if the smell were removed without destroying their medicinal properties.

The prevailing idea of the complainant's specification is, that he has invented a process of removing the offensive odour peculiar to heavy hydro-carbon oils.

He states in his specification that his "invention relates to heavy "hydro-carbon oils"—that "it has been the practice to treat such "oils with acids and alkalies, for the purpose of removing the *dis-*"*gusting odour peculiar to these oils.*"

That he takes the heavy oils and treats them as described, and that "the matters which go over to the condenser have a very foul, "offensive and disgusting odour, but that the oil remaining in the still "is free from the characteristic odour of hydro-carbon oils and has *no* "*smell* but a slight odour similar to that of fatty oils."

In speaking of the result of his process he says further (p. 10,) "It [his oil] has been so completely *divested of its fœtid and pun-*"*gent odours*, having only a slight smell like fatty oil," &c.

It may perhaps be said that an oil perfectly deodorised is the same as one that never had the peculiar odour referred to; but when it comes to a question of invention, and the similarity or dissimilarity of an oil as a new article of manufacture, surely there is an essential difference between an article which has been treated for deodorisation, *when that is the only point of novelty in the patent*, and an article which has not and never had the objectionable smell because made by an entirely different process.

We now propose to shew that the process by which the neutral topaz oil sold by the defendants is made, was practised, and the neutral topaz oil made by it, by Dr. Tweddle, long before the invention of Merrill; so that if the Merrill patent be construed to cover such process or product, his patent is void for want of novelty.

(For this purpose we reproduce the able and elaborate brief prepared by Wm. Bakewell, Esq., of counsel with the defence in the court below, and used at the hearing in that court.)

Dr. Tweddle was educated in England as a physician, and has made chemistry, in its application to manufactures, a special study since the year 1849, and especially with relation to the distillation and refining of oils and fats, particularly rosin oil, palm oil and turpentine oil. He is also familiar with the distillation of coal-tar, and the chemistry of gas-making. In the years 1851 and 1852, he was engaged as assistant to his father in his very extensive works in Liverpool, England, manufacturing soaps, refining oils, and making sulphuric and other acids. His principal business, however, was the refining and bleaching of oils. He came to the United States in 1853, and was employed in instructing manufacturers in the application of chemistry to the refining of oils, fats, soaps, &c., in New York, and in 1856 in Providence; and in 1856 and 1857 in the manufacture and refining of cotton-seed oil in Providence and St. Louis. He claims to have been the first to bleach cotton-seed oil white. In the year 1857 he took the management of large cotton-seed oil works in St. Louis, and went to New Orleans in 1858, where he conducted a series of experiments in distilling and refining rosin oil. He distilled rosin oil, coal-tars and vegetable oils by *fire and superheated steam*, with and without *vacuum*. His object was to deodorise rosin oil and make it white, for burning and lubricating purposes. He then finished the erection of the Louisiana Oil Works for distilling rosin oil on a very large scale.

About this time, 1857, petroleums were introduced as burning oils, and attracted a great deal of attention, the production of this

natural oil from wells having introduced a new article of commerce and manufacture.

Dr. Tweddle was admirably prepared, by education and practice, for entering this new field of scientific investigation and practical operation. In 1859 he experimented in the distilling of petroleum, and having constructed the Pelican Chemical Works in New Orleans, in 1860 he left New Orleans, intending to return to England. But, coming to Pittsburgh, he visited Samuel M. Kier, of that city, in whose wells petroleum was first discovered, and who was the first, and then the largest, distiller of petroleum in the United States.

Tweddle visited Kier's works, and found the art of distillation in its infancy, and in a very crude state. Distillation was conducted with direct fire alone. The distillates produced were refined only by acids and chemical treatment, and the method of converting the entire mass of crude petroleum into burning oil, since practised under the name of "cracking," was, we believe, not yet in use.

Here was an opportunity for Tweddle to bring into use his previously acquired scientific and practical knowledge. He saw at once that the distillation of petroleum, as then practised, was based upon a wrong theory; that the heat employed was too strong, and not sufficiently easy of control; and he accordingly suggested to Mr. Kier improvements in his apparatus and mode of operation, including the use of superheated steam in the stills, in addition to the fire heat, and the use of a vacuum. These suggestions, with the exception of the use of vacuum apparatus, were adopted and put into practical operation in Kier's works on Seventh street, Pittsburgh.

(A sketch of this apparatus is shewn in Exhibit 32, described p. 159, ans. 43.)

In this apparatus the steam was superheated in exactly the same way as is described in complainant's patent of May 18, 1869, on which this suit is brought.

This use by Tweddle anticipates and antedates the devices claimed in second claim of complainant's patent; but this point will be more particularly considered hereafter.

In March, April and May, 1861, Tweddle built new stills at Kier's works at Freedom, Pa., introducing into four of them the super-

heated steam-coil, with its steam-pipes and stop-cocks arranged substantially as described in Merrill's patent (pp. 159, 160).

This apparatus is shewn in Exhibit 33; it was put into successful operation in 1861.

During the same year, 1861, Tweddle finished the Enitesco Petroleum Works of Sellers, Canfield & Co., introducing superheated apparatus, and putting it in operation. He also, in the summer, fall and winter of 1861–2, built and put in operation seven other large oil distilleries in Allegheny County, Pennsylvania, all having his improved apparatus, but not the *vacuum* stills.

By these means, Dr. Tweddle greatly improved and simplified the process of distilling oil, substituting one distillation for two, one refining process by chemicals instead of two, and making white, merchantable oil (p. 159, ans. 42).

The introduction by Tweddle of the use of steam, even without vacuum, as a means of vaporising the oil at a low temperature, was a very important improvement, as it not only made the distillation more rapid, but modified and improved the character of the distillates heavier than burning oil, or below 38° Beaumé. See *Merrill's* dep. page 415, ans. 7.

Merrill also says (page 513, ans. 15), "Steam used during the "distillation is a powerful preventive of cracking, and brings the "vapours over at a much lower temperature than is the case where "fire distillation alone is resorted to."

And Atwood gives as the reason (page 440, ans. 17), that "steam "forms a vehicle for transporting the vapours out of the still, at a "lower temperature than they would otherwise be removed under," and diminishes cracking, because it tends to prevent the condensation of the vapours before they leave the still.

In the spring of 1862, Tweddle designed the Standard Oil Works, which he erected, and the conduct of which he superintended until he left them in December, 1866 (p. 162). These works were very extensive; he designed to introduce his vacuum apparatus there, and the vacuum pans were ordered; but not being constructed in

time, and to avoid the delay of several months, the plan was changed, and they were not used.

He, however, introduced his other improvements; viz., the apparatus for using steam and superheated steam, so as to distil crude petroleum at lower temperatures.

Dr. Tweddle, being familiar with the beneficial effects of the use of a vacuum in combination with superheated steam heat in distilling other oils (ans. 20, p. 156), applies for a patent for his improved mode of distilling hydro-carbon oils, which resulted in the grant to him of his patent of 4th February, 1862 (p. 539).

(The foregoing narrative, as to Dr. Tweddle, is condensed from pp. 155–162 of the record.)

At this point we ask attention to the Tweddle patent of 1862.

It describes and represents a still in which oil is to be vaporised by the use of steam instead of fire, means of introducing superheated steam into the body of that oil to give the requisite heat to vaporise it, and means of producing a vacuum in the still, so that the comparatively low heat furnished by the superheated steam shall suffice to vaporise the oil.

The prominent features referred to in this patent are, —

1. The use of steam and superheated steam, instead of fire heat, for distillation of petroleum.
2. The use of a *vacuum* in the still, to vaporise the oil at a low heat.
3. The consequent ability to distil over the *heavy* oils.
4. The conduct of the process without destructive distillation or decomposition of the oil.
5. The non-production of coke or tarry matter in the residuum.
6. The nearly *odourless* character of the distillate.
7. The nearly *odourless* character of the residuum.

The description of the process in this specification is meagre; but it will be noticed that he mentions specially that by means of the vacuum the distillation becomes *very rapid*.

It is submitted that the fact being, that by the use of vacuum in the still and condenser, as described in this patent, and with the aid of steam and superheated steam to vaporise the oil, the results claimed by Dr. Tweddle are produced, and that these conditions, and these *only*, are necessary to the production of his neutral topaz oil as a really odourless distillate of heavy gravity, is sufficient to sustain the right of Dr. Tweddle to continue his manufacture, which he practically commenced, as we shall see, in May, 1867, several months prior to Merrill's alleged discovery.

And that the 3d claim in this patent, which is in the following words: —

> "The use of the vacuum apparatus R in combination with the "steam-pipe F, arranged in the interior of the still, substantially, "as described" —

leaves no room to doubt the substantial identity of the process therein described with that now used by Dr. Tweddle by which he produces his neutral topaz oil.

This patent was applied for some time prior to February, 1862, when Tweddle had not, as far as appears, tested practically the *combined use of vacuum and superheated steam* in distilling petroleum. This, however, is the subject of his patent, and the whole testimony in the case proves that the idea, thus reduced to practice, is the basis of Tweddle's invention, by the use of which *alone*, so far as is now known, can *crude petroleums* be distilled so as to prevent decomposition and avoid the generation of those offensive odours the removal of which is the purpose of Merrill's invention.

And further, that the use of the apparatus claimed and process described (of superheated steam and vacuum) in this patent of 1862, will necessarily result in the production of his neutral topaz oil.

At the time when this patent was taken out, there was great anxiety by reason of the fires which occurred in petroleum distilleries, arising from the use of fire under the stills; hence Dr. Tweddle lays great stress on the advantages of this mode of distilling petroleum, arising from the security which is offered in this respect, and scarcely alludes to any others.

But between the time of taking out this patent and the time of re-issuing it in 1866, he had had occasion to demonstrate practically the other advantages which his new system of distillation presented.

The Standard Oil Works, erected in 1862, were regularly operated, under the superintendence of Dr. Tweddle, with fire and superheated steam and *no* vacuum. But during those years he experimented with a *vacuum* still, using also superheated steam (p. 191, ans. 183), and obtained the following products of distillation from petroleum; viz., —

1. Burning oils with very little odours compared with those of fire distillation.

2. Heavy paraffine oils with very little odour. Both of these were almost devoid of blue colour or fluorescence.

3. Residuum almost odourless.

4. *No* tar or coke.

The burning oil and heavy paraffine oil were distillates.

This he repeatedly did in the years 1864, 1865 and 1866 (p. 163, ans. 65).

The heavy paraffine oil then produced was yellow, something like olive oil, density between 33° to 35° Beaumé, with very little odour (p. 163); it was the same oil as Exhibit No. 55; that is, it was the same as the neutral topaz oil as it runs to-day from the still, without chemical treatment (p. 169).

The residuum in the still was dark greenish-brown in colour, almost inodorous, and viscid (p. 163).

Thus it will be seen that in the years 1864, 1866, Dr. Tweddle produced the same products as he now makes, viz., burning oil, neutral topaz oil, and dark-coloured machinery oil.

Re-issue in 1866 *of Patent of* 1862.

Next we ask attention to the re-issue which Dr. Tweddle took in 1866, after he had made these demonstrations of the capacities of

his new mode of distillation as it regarded *products*. It is printed on page 541 of the record.

He states that the principal objects of his invention were not only to avoid the danger from fires, but "to conduct the operation of dis- "tillation at a *lower and more uniform degree of heat* than is required "by the ordinary modes of distillation."

He speaks of *the loss of oil by destructive distillation* in the old process.

He points out that, by the use of vacuum, the heat required is "considerably less, being only about 380° Fahrenheit, where 580° "would be required without the vacuum."

He then points out the desirableness of using superheated steam, so that this comparatively low temperature may be obtained without dangerous steam pressure.

As to the efficiency of *vacuum* he says: "By means of the with- "drawal or reduction of the atmospheric pressure thus effected, the "distillation progresses very rapidly, at a low temperature, compared "to that which would otherwise be required."

This effect of the removal of atmospheric pressure, in securing the ebullition and vaporisation of fluids at lower temperature, is well known; so that even by the changes of atmospheric pressure caused by ascending a high mountain, water boils at so low a heat as seriously to retard the operation of cooking food. Atwood tells us, p. 441, cross 26, that water boils *in vacuo* at about 100° F. (its boiling point under atmospheric pressure being 212° F.). He also says, that the use of vacuum in a still for distilling petroleum would reduce the required temperature between forty and one hundred degrees. How great, then, must be the effect when the pressure of the atmosphere is almost entirely removed, so that some fluids will boil and pass into vapour even without any applied heat.

Tweddle, in this specification, not only speaks of these advantages of using vacuum and superheated steam, but he also points out a characteristic feature of his process which distinguishes it from all others previously known, and the reference to which clearly proves that he then had not only described, but had practically tested, his process.

This feature is the *non-production of coke or tarry residuum* in his stills.

In fire distillation, if the still is run to dryness, hard coke or solid carbon is formed and deposited; if the distillation is not proceeded with till the still is run dry, a tarry residuum is left in the still, and the non-production of coke and tarry matter by Tweddle is due to the *non-destructive* distillation employed by him, *which results in the production of his neutral topaz oil as a distillate.*

This will be dwelt upon more at length hereafter, and is here referred to as a test of the fact that Tweddle's process of 1862, as described in the re-issue of 1866, is substantially what he now uses.

He says in his specification (p. 542), —

> "By the use of superheated steam in combination with a "vacuum, or partial vacuum, I am enabled to distil *even the* "*heavy products* of petroleum and other oils, and at the same "time avoid in a great degree the decomposition of the oils into "non-condensable gas *and the elimination of solid carbon in the* "*shape of coke or tarry residuum*, which is deposited in the "bottom of the stills when fire heat is employed."

If it is contended that in this specification there is no *process* described having any reference to the production of any other than light burning oils, we refer to the mention of the distillation of *heavy products* of petroleum in the above clause as a complete answer. It is evident that he contemplated the production of heavy oil as *distillate*, and this distilled heavy oil can be nothing else than the neutral topaz oil.

The very object stated in the specification is, to distil over the heavy oil without decomposition; and this he effects by the comparatively low heat rendered sufficient for this purpose by the employment of superheated steam and vacuum.

He also clearly refers to more than one product of distilled oil; a heavier and a lighter product, as follows (p. 544) : —

> "When all the oil is distilled which will pass over at the heat "*first* employed, I increase the temperature up to 120 lbs. pres-

"sure to the square inch, after which I commence to use super-
"heated steam; by which means I can safely attain any degree
"of heat requisite to distil the *heavier oils* remaining undistilled
"at the degree of heat first employed."

The expression, "I increase the temperature up to 120 lbs. pres-
"sure to the square inch," refers, obviously, to the increase of heat applied to the steam-generating apparatus, as there is almost no pressure, but a *vacuum*, in the *still*.

He increases the heat by using superheated steam; but this increase, as the whole specification shews, is not an increase as compared with the fire heat used by ordinary processes (other than Tweddle's), but merely the use of such, and no more, additional heat as is necessary to distil over the heavier oils; and this heat, he tells us, being given by superheated steam combined with vacuum, is so low as not to decompose the oil or produce any residuum or coke in the still.

It must be remembered that by every and any process of distillation greater heat is necessary to distil the heavier than the lighter oils.

Atwood, p. 441, cross 30.
Tweddle, p. 167, ans. 98.

The lighter oils, requiring a less heat, come over first; and the heat must be increased to effect the distillation of the heavier oils, if at first it was no greater than sufficient to distil over the lighter oils; otherwise the process would cease.

It remained for Tweddle to invent the mode of distillation by using, at all stages of distillation *only* so much heat as is necessary to distil over each of the various grades of oil successively, under the condition of the removal of atmospheric pressure, and thereby to prevent the decomposition of the oil and the formation of the offensive thin oils which impart their characteristic smell to the distillate in fire distillation.

It is objected, however, by Merrill in his testimony, that there is a statement in this re-issued specification which proves that Tweddle

contemplated the cracking or decomposition of his oil by the process described in the re-issue of 1866. This clause is as follows (p. 544) :—

> "The quantity of *illuminating oil* thus produced from a given "amount of crude petroleum is greater by from 12 to 15 per "cent by my process."

It does not appear, we think, in the testimony, at what date the process of "cracking," or breaking up of heavy oils by distillation into those of lighter gravity, was introduced into the art of petroleum distillation. It is referred to as a patented process, however. Tweddle does not say expressly in this clause with what process he compares his own, but throughout his specification he is speaking of the difference between the use of steam, or superheated steam with vacuum, and the use of fire. He evidently means, therefore, that the yield of illuminating oil is greater up to the point where heavy oil begins to come over from the condenser than it is where fire heat is employed.

That he cannot mean to refer to *cracking*, is manifest when we remember that by the process of cracking, the *entire mass* of crude petroleum is convertible into *burning* oil, excepting only the solid coke left when the still has been run to dryness by the old fire process. More than this could not be obtained by any process.

See *Atwood's* testimony, p. 30, ans. 60.
Merrill, p. 414, ans. 3.

He does not, therefore, compare his process with cracking.

What Tweddle meant was merely, that up to the point where the run of burning oil ceases and the heavy oil begins, the yield of burning oil is 12 to 15 per cent greater than if decomposition had taken place.

And it is a fact, as stated by Tweddle, that the use of his process — steam and vacuum — will increase the yield of illuminating oil from petroleum, as compared with the fire process previously

known, up to the point where the heavy oil is produced, and without any cracking.

This is proved by the testimony of Merrill. In describing (on p. 413) the old process of fire distillation, he says that after the naphthas are distilled over, "then comes an oil which is classed as illuminating "oil, beginning at a gravity usually of from 58° to 60° Beaumé." This proceeds until a gravity of about 42° is reached. "The next "products, between 42° and about 40° Beaumé, are yellow in colour, "*too oily in body for illuminating oil, and not oily enough in body for "lubricating oils.*" The next yield is lubricating oil, 36° Beaumé. The percentages he gives for 45° oil are: naphtha, 15 per cent; illuminating, 45 to 50 per cent; the portion between 42° and 36° Beaumé, *fourteen to twelve per cent;* and finally, there is a loss from coke and gas.

Now Tweddle saves this middle yield of 10 or 12 per cent as illuminating, and also makes no condensable gas, as he states in his specification. And here it is that he gets his 12 to 15 per cent more illuminating oil, as stated in his specification.

That this is the result of the use of steam, even without vacuum, is evident from the statement of Merrill (p. 414), that where distillation is performed rapidly, and decomposition is prevented as much as possible, the portion coming over lighter than 38° Beaumé is suitable for illuminating oil; and on p. 56, in speaking of the present mode of making burning oil, he places its gravity as all above 40° Beaumé.

But more: we must assume that the process described in the reissue of 1866 produced the results there described. If it produced the result of getting 12 to 15 per cent of illuminating oil more than by the old process, it *must* have involved the production of illuminating oil *down to* the production of lubricating oil, and the deposition of no tar or coke; for not otherwise could this gain of 12 to 15 per cent be possible. Now this production of, first, illuminating oil, next (without any intervening oil), lubricating oil, leaving residual oil with *no coke or tar*, is exactly what Tweddle does now.

There is nothing, therefore, in this clause of the specification, to indicate that cracking was contemplated by Tweddle in this patent;

and the interpretation we give to it is entirely consistent with the other parts of the specification, while the interpretation sought to be put upon it by Merrill is utterly inconsistent.

The supposition that the increase of heat mentioned in the re-issue of 1866 would result in the cracking of the oil, is further contradicted by Merrill's own testimony (p. 56, ans. 29), where, in speaking of the "means employed in the treatment of the crude material when "the manufacturer designed to produce from that material a burning "oil," he first describes the distilling off of the naphthas down to 60° Beaumé; then the distilling over of the oil until it reaches the gravity of 40° Beaumé. He then proceeds: "At this stage the fires under the "still *are damped*, and the distillation *conducted more slowly*, guided "by the character of the oil running from the condenser; the object "being to maintain the flow of oil from the still at a gravity of not "heavier than forty Beaumé, and of as light a colour as possible. As "the distillation proceeds, the *fires have to be gradually reduced in* "*strength*, and the oil flowing from the condenser much diminished "in volume, in comparison to that where the body of the burning "oil was being distilled, and before the gravity had reached forty "Beaumé."

The *increase* of heat at that stage of the process (where the higher gravity oil is distilled over) was not the way to produce cracking; and it is most obvious that the effect of the vacuum would be the very opposite of allowing the vapours to fall back in the still, and, as all the evidence shews, it is the very best thing to prevent cracking.

It is worthy of remark in regard to the statement of the specification as to the increase of the production of illuminating oil, that the fact of referring to the increased product of *illuminating* oil, taken in connexion with the statement in the specification (p. 544), that he first distils over the *lighter gravity oil*, and afterwards "*the* "*heavier oils* remaining undistilled at the degree of heat previously "employed," is an additional proof that his process contemplated the production of two grades of oils as distillates; 1st, lighter oils; 2d, oil of heavier gravity; and that the lighter oil was illuminating oil. It follows, therefore, of necessity, that the heavier oil was

heavier in gravity than the illuminating oil, or in other words, it was distilled heavy hydro-carbon oil, of a gravity below that of burning oil. This is nothing else than neutral topaz oil, if it complies with the other requirements as to colour and freedom from smell.

And the specification is not wanting in a clear statement in this regard. We quote from page 544:

> "In addition to the advantages already stated as resulting "from my improvement, the oil resulting from distillation, by "the process described, is *almost entirely devoid of the acrid "and unpleasant odour of fire-distilled oils, and is almost col- "ourless.*"

Thus we have described in re-issue of 1866 an apparatus containing all the elements that are necessary to carry on Dr. Tweddle's process at the present day.

As to apparatus:

A still without any furnace for direct fire.

Pipes for the direct introduction of steam and superheated steam into the still to give the requisite heat for distillation.

A vacuum apparatus for removing atmospheric pressure.

A condensing apparatus for condensing the vapours of distillation.

A set of receivers for receiving the condensed oil by fractional distillation.

As to process:

The mode of heating the oil so as to vaporise it by steam under vacuum.

The use of a low degree of heat as a special object.

The distilling of both light and heavy oils.

Such increase of heat as to enable the heavy oils to be carried over as distillates after the run of light oil has ceased.

The non-destructive distillation of the oil.

The non-formation of permanent gases.

The non-production of coke or tarry residuum in the stills, as an effect of the low degree of heat employed throughout the process.

The odourless character of the distillate.
The odourless character of the residuum.

And in this re-issue we find the following claims in addition to those made in his original patent of 1862 : —

1. "Distilling hydro-carbon oils, such as petroleum and other "substances, under a vacuum or partial vacuum, by the use of "steam, for producing the vaporisation of the article to be dis- "tilled.

2. "The use of superheated steam, in combination with the "employment of a vacuum or partial vacuum, for the distilla- "tion of petroleum and other hydro-carbon oils, and similar "substances."

Dr. Tweddle, then, was clearly, at the date of the re-issue of this patent (Nov. 27, 1866), in possession of the process and the apparatus for the practical working out of the process by which his neutral topaz oil is produced to-day.

It cannot be successfully denied that he could obtain in this apparatus the "*heavy products*" of distillation of petroleum without decomposition, and *that* by reason of the vacuum which he maintained in the still, combined with the use of superheated steam.

And there is nothing in the testimony to disprove the position, that by the use of the apparatus and process of the patent of 1862, as re-issued in 1866, the products would be precisely the same as he now produces, including the neutral topaz oil as it runs from his stills at the present time.

It is clear, then, that Dr. Tweddle had, as early as February, 1866, and before he erected his own Eclipse Works at Sharpsburg bridge, all the elements of a regulated manufacture, involving and including his neutral topaz oil; and, we shall see he thereupon proceeded to establish it; and it is this manufacture which the complainant seeks to arrest.

Tweddle's operation in vacuum distillation, when starting to manufacture on his own account.

In October, 1866, Dr. Tweddle was induced, by reason of the success of his experiments with vacuum and steam distillation at the Standard Works, to put up works of his own for carrying on his process of vacuum distillation of petroleum.

He purchased the property at Sharpsburg bridge, from Archibald Kelley, in October; and in December, 1866, commenced the erection of these works, and then left the Standard Works. Joseph Clarke, who was in Dr. Tweddle's service at the Standard, accompanied him to the Eclipse Works, where he was foreman until 11th September, 1868.

Clarke, p. 279, ans. 13 to 24.

The Eclipse Works were put in operation May or June, 1867.

At these works Dr. Tweddle erected first a cast-iron vacuum still. Model Exhibit 124 correctly represents this still, excepting that the condensing tank is made half-length to save room, and the condensing pipes are bent round instead of being straight. The end of the condenser pipe was attached to a vacuum pump for creating a vacuum in the still, and pumping away the distillate. This was completed and put in operation in May or June, 1867. The still was not heated by a fire, but by superheated steam introduced by pipes into the still.

Tweddle, p. 164; p. 479, ans. 76.
Clarke, p. 279.

In this cast-iron still Dr. Tweddle manufactured, with steam and vacuum, from crude petroleum, burning oils, lubricating oils and paraffine, and had left in his still as a residuum a heavy green lubricating oil, and *no coke or tar*.

As to the character of these products, Dr. Tweddle tells us that the burning oil was white high fire test, totally devoid of fluorescence or blue colour such as characterises burning oils distilled by ordinary fire process, and had not the objectionable odour which

characterises ordinary fire-distilled burning oils (p. 164, ans. 79). It was sold without further purification by acids or alkalies.

With this still he also made his neutral topaz oil — exactly the same oil as he now makes.

Tweddle, pp. 172, 173, ans. 134, 135.

Joseph Clarke, the foreman, confirms these statements; he says that this still was heated with superheated steam, that crude oil was distilled in it, that they had a vacuum in the still; that the first distillate was benzole, the second illuminating oil, average gravity 45° or 46°; the third a heavy yellow oil, about 30° to 32° gravity, and that these products were kept separate; this was called spindle or machinery oil, and the heavy residuum left in the still was called Eclipse railroad oil; a dark-green oil (pp. 280, 281); that the colour and odour of the spindle and machinery oil was about the same as the neutral topaz oil as now made by Dr. Tweddle; and on p. 284, ans. 89, he tells us that this oil was precisely the same kind of oil as the neutral topaz oil.

As to the odour, Dr. Tweddle tells us (pp. 164, 165, ans. 81, 82), that the offensive odours of paraffine oil did not exist in either the residuum or the distillate manufactured in this still; and he gives as the reason, "crude petroleum distils at lower temperature *in vacuo* "than under atmospheric pressure. Owing to the lower temperature "the oil is not decomposed, and the bad odours which characterise "the distillates of fire distillation are not generated, where crude oil "is distilled *in vacuo* by superheated steam. Crude petroleum con- "tains more or less sulphur. Whenever you decompose hydro-car- "bons, at high temperature, in the presence of sulphur, bad odours "are generated." And (on p. 167, ans. 99) he says, —

> "By the use of superheated steam in a vacuum, I do not "reach such high temperatures as are reached in distilling petro- "leum by fire under atmospheric pressure; nor do I decompose "the oils precipitating coke and tar, nor do I generate offensive "oils to be carried over with the distillate. When you distil "under atmospheric pressure you reach temperatures 650° Fah-

"renheit, to a low red heat on the bottom of the still, and pre-
"cipitate tar and coke."

This first apparatus continued to be used by Dr. Tweddle in the manufacture of these products, including his spindle oil (now called neutral topaz), while he was at the Eclipse Works, but not much while he was building his new stills, from September, 1867, to May, 1868 (p. 201, cross 86).

Dr. Tweddle first gave the name of neutral topaz to the spindle oil in the fall of 1868 (p. 209, cross 165).

This neutral topaz oil was not perfectly free from odour. Dr. Tweddle never claimed it to be so (p. 176, ans. 156). This also is the case with the neutral topaz oil he now makes, but Merrill claims that he can make his oil by his process as *odourless as granite* (p. 52, ans. 13).

Dr. Tweddle made neutral topaz oil in the cast-iron still put up at the Eclipse Works in May, 1867.

The process was briefly as follows, as described by Dr. Tweddle (p. 170, ans. 124): —

"Introduced crude petroleum, which had been deprived of
"naphtha, into a vacuum still, and with the aid of superheated
"steam distilled off the burning oils, and heavy paraffine oils,
"with very little odour, leaving in the still a residuum which
"contained neither tar nor coke."

In speaking of the difference between his process and that previously used, he says (same answer), —

"In the fire distillation under atmospheric pressure very high
"temperatures, being upwards, at the latter end, of 600° F.,
"whilst in my process per vacuum and superheated steam, low
"temperatures are used."

Between May and September, 1867, Dr. Tweddle accumulated between 100 and 150 barrels of this oil at his works (Tweddle, p.

229, ans. 197; Clarke, p. 282, ans. 61), most of which he kept until 1868.

Having no paraffine presses erected at that time, he instructed Clarke to press some of this neutral topaz oil, and remove the paraffine therefrom, which was accordingly done by Clarke, with a drill press, in the month of September, 1867.

Clarke, p. 282, ans. 60.

This neutral topaz oil, some of it clear of paraffine, but most of it with the paraffine in, was sold and given away by Tweddle in order to test its value as a lubricating oil, and it was seen by several other persons whose testimony is given.

It is well known that oil manufacturers are in the habit of preserving in sample bottles, specimens of the oils made by them from time to time, and especially when any new or improved product is obtained; and the fact that Tweddle has not been able to produce any specimens of the identical neutral topaz oil manufactured between 1864 and 1866, while at the Standard Works, or of that made at the Eclipse Works prior to September, 1867, is fully met by the fact that on 25th September, 1867, his dwelling-house, with all its contents, was burned to the ground, and that afterwards, on 28th June, 1870, the Eclipse Works, including his residence, were utterly destroyed by fire, so that he lost all his books, papers, samples and memoranda. Had these disastrous fires not occurred there would have been no difficulty in producing specimens of the products actually there obtained from his still.

It may be thought remarkable that Dr. Tweddle, who claims for his process peculiar immunity from danger of fire, should twice have suffered from it; it is well then to state that his house, burned at the first fire of September 25, 1867, was detached from his works, and that the fire was not caused by oil; and that the Eclipse Works were destroyed on 28th June, 1870, by one of the oil tanks being struck by lightning, which burst the tank, set fire to the oil, and also killed Dr. Tweddle's bookkeeper, Mr. Foster. Had this gentleman been living, he could have furnished important information in regard to the Doctor's operations.

It is also worthy of remark, that Merrill has not produced a single specimen of any of his deodorised oil as made by him at any date prior to the grant of his patent. When it comes to a question of similarity of oils or delicate questions of colour and smell, it would certainly be satisfactory to have had some proof that he did, prior to the date of his patent, make oil such as he *now* produces as his deodorised oil. There is evidence to prove that he has been improving his oil; and if he has, it is not now what it was then; and for aught we know it may, when he first made it, have differed from what he now makes far more than Tweddle's oil now differs in appearance, colour, smell and gravity from his; and Merrill himself has not stated that the oil he himself made before the date of his patent was identical in these respects with his present oil, with which he compares the neutral topaz of Tweddle's manufacture.

Merrill's patent having exclusive relation to heavy paraffine or lubricating oils, the controversy in this case has been directed chiefly to this class of oils. We must not overlook the fact, however, that the scope of Dr. Tweddle's invention and of his patents is very much wider, embracing the distillation of petroleum broadly, that is, irrespective of the grade of oil to be produced, so that the manufacture of illuminating oils is covered by it as well as that of lubricating oils; and the demand for the former being manifestly much greater, it was to the Doctor at that time the more important branch of the business to which to apply his process.

Dr. Tweddle could carry on his process in his manufactory, so as to produce illuminating oil to great advantage, as by it all the distillate down to 38 or 40 was suitable for that process; and as his process was not adapted to the conversion of *all* the crude petroleum into illuminating oil, it being almost, if not quite, impossible practically to crack the oil when using steam and vacuum, it became important, in order to shew to the other distillers the advantage of adopting his process of 1862, to shew also that the residuum below 38° gravity was a very valuable, and not a waste, product; not an offensive tarry substance, such as is produced by fire distillation, and which needed to be redistilled to make lubricating oil, but that it was admirably adapted for lubrication without further treatment.

The large amount of lubricating oil required by the railroads, and by the various machine shops, gave a ready market for this article. Hence he called it Eclipse lubricating or railroad oil.

The class of oils best adapted to the production of illuminating oil were the lighter gravities of crude petroleum, and these yielded but a comparatively small percentage of the neutral topaz oil, the relative yield of the different gravities of oil as distillates, where cracking is not resorted to, being dependent chiefly on the character of the crude article.

With a view to the introduction of his patented process into public use, Dr. Tweddle issued in August, 1867, a prospectus for getting up a stock company for carrying on his manufacture. This prospectus, Exhibit No. 77, is put in evidence by complainant, and is inserted on page 242 of the record. Some newspaper articles published also in August, 1867, in the "Pittsburgh Commercial," Exhibits 71 and 72, were also introduced by complainant.

The first of these publications, Exhibit 71, is an article from the "Pittsburgh Commercial," published August 3, 1867, being a description of Dr. Tweddle's works and process, by the newspaper reporter, in which the writer dwells chiefly on the absence of fire, and the fact that Dr. Tweddle uses no chemicals for refining his oil, makes no tar or coke, and produces a refined petroleum which is almost odourless (p. 235).

The next, Exhibit 72, is a newspaper article of August 17, 1867, drawing special attention to the fact that Dr. Tweddle makes none of the disgusting substance usually run into the river by the ordinary refineries, and the safety from conflagration in consequence of his not using fire; it refers also to a prospectus published over the name of S. M. Kier & Co. for a company to operate under Dr. Tweddle's patent (p. 237).

This prospectus forms the next exhibit, No. 73, and refers to the non-use of fire, and the substitution of steam, the odourless character of the refined oil, and the non-production of tar and coke; and offers stock for sale and invites inspection of the works (p. 238).

These exhibits are, we suppose, offered in evidence by the com-

plainant on account of the absence of any reference in them to the neutral topaz oil; but it will be noticed, also, that there is no reference to the use of vacuum, excepting the mention of the two pumps, which are not, however, stated to be vacuum pumps.

These publications were evidently not intended as an exhaustive description either of the process or apparatus, but merely designed to draw attention to those features which would be most calculated to impress the public favourably.

Another exhibit, No. 77, is a pamphlet published on August 15, 1867, by Dr. Tweddle, giving a more detailed description. This is a prospectus of the stock company proposed by Dr. Tweddle to be formed for manufacturing under his process at the Eclipse Works. It mentions specially the use of steam and the absence of fire; the dispensing with the use of acids or chemicals to purify the oil, and the increased percentage of yield and high fire-test of the oil, and the cheapness and rapidity of the process. It says: "There is no char-"ging of the stills, no cleaning out of tar or coke, no bad odour, no "dirt. There are no waste products."

It mentions that the residuum, after the illuminating oils are obtained, is a heavy green lubricating oil from 20° to 28° Beaumé. It is almost odourless, &c.

A statement is then gone into, to prove the economy of the process by figures; and illustrates it by stating that the year previous (when he was at the Standard Works where his vacuum process was not used) he redistilled the tar down to coke to get the same percentage of yield.

The prospectus proceeds as follows: —

> "By the ordinary process in use very high temperature (at "the later stages of the process exceeding 600° Fahrenheit) is "used in distilling, and from 10 to 12 per cent of the oil is de-"composed or carbonised; usually four or five per cent of the "tar is run from the stills into the river, and from one to three "per cent is carbonised by the sulphuric acid, or is lost in sub-"sequently washing in the agitators."
>
> "By Dr. Tweddle's process the oil during the operation *is in*

"*a vacuum*, and the *temperature is very low*, seldom exceeding "350° Fahrenheit, which heat is obtained by steam, so that *none* "*of the oil is burned or wasted by decomposition*" (p. 244).

The only still which he had at that time at the Eclipse Works was the cast-iron still so often referred to in the testimony; and these publications, all made in August and September, 1867, shew that Dr. Tweddle then claimed that, by the use of this same cast-iron still, he did not decompose the oil, and made no tar or coke; and that he then, as now, attributed these characteristics of his process to the use of steam and vacuum.

On the 9th of September, 1867, Dr. Tweddle had a public exhibition of his apparatus and process at his works, of which a report was prepared by a committee selected on the occasion, which report is given in Exhibit No. 75, page 240, and an amended report in Exhibit No. 76, page 241. There is also a newspaper notice, published on September 10, 1867, Exhibit No. 74, page 240, referring to the same thing. These are all put in evidence by the complainant.

The persons present at this public exhibition were chiefly manufacturers of refined oil, and their report is so general in its terms that it does not tell us much more than that the apparatus and process were different from, and superior to, those in general use, and that the result was remarkable and satisfactory.

So far as it goes, however, it corroborates the testimony of Tweddle and Clarke in regard to the apparatus at the Eclipse Works. We learn that, from 43° gravity crude petroleum, there was distilled 74 per cent of refined oil, and 22 per cent of lubricating; the latter we are left to infer to have been the residuum in the still. We were told what were the gravities of these products, and even the statement as to the "prime white" oil does not refer to the product of that trial, but to the illuminating oil on hand at the works at the time. How much of the 74 per cent of distillate was above 38° gravity, and how much, if any, below, we are not told. The crude oil used was 43° gravity, so light that it would yield but a small percentage of neutral topaz.

Dr. Tweddle states (p. 480, ans. 86–88), that the 74 per cent of oil produced at that trial contained some of the heavy-gravity distillate also, as the distillation had reached the point where it began to show colour, or where it had become too heavy for refined oil, sometime previous to the distillation being stopped.

The reasons which Dr. Tweddle assigned for making no mention of the special products of his process (neutral topaz and the improved character of the refined paraffine), are certainly sufficient satisfactorily to rebut the inference sought to be drawn from his silence as to his not having made those oils at that time.

These reasons were, in substance, that there was at that time no large demand in the Pittsburgh market for petroleum lubricating oils, and that the attention of the Pittsburgh manufacturers had been directed solely to making illuminating oils; that he had himself built almost every large refinery in Pittsburgh during the years 1860 and 1861; that he knew when he built his Eclipse Works what valuable products in lubricators he could produce, but that, being embarrassed in 1867, for want of sufficient capital to carry out his plans, he published this prospectus and pamphlet to induce manufacturers to take stock in his concern, presenting those features which they could appreciate; especially that he could make his oils without producing any tar or coke, and that the residuum, instead of being an offensive waste product, was a highly valuable and sweet lubricating oil, for which he already had a market. The importance of the non-formation of tar and coke arose from the fact that it amounted to from 8 to 12 per cent of the amount of oil distilled, which was run into the river as a waste product by other manufacturers. These considerations, together with the absence of offensive smell in his process and the safety from fire, he knew they would appreciate; while if he had talked about his new products which the manufacturers knew nothing about, they would have been shy in loaning him their capital (Tweddle, pp. 229, 230, ans. 198–200).

It must also be remembered in this connexion, that this process of Dr. Tweddle's could, if desired, be carried on so as to stop the distillation when the oil reached the lowest proper gravity for burning oil, leaving all that remained as lubricating residuum in the still.

Soon after this exhibition, Dr. Tweddle went to New York with a view to the organisation of his proposed company, having previously had several communications with Mr. L. L. Lombard, of that city, on the subject. On the 16th or 17th September, 1867, he took to Mr. Lombard specimens of the products of his steam and vacuum process, viz., burning oil, neutral topaz oil, residuum and refined paraffine.

Tweddle, p. 173, ans. 137, 138.

Mr. Lombard testifies (p. 274) that in the fall of 1866, while Dr. Tweddle was yet at the Standard Works, he told him that he (Tweddle) had a patent for making oil *in vacuo*, that he could make oil much cheaper and better, and that he could make kerosene to stand a much higher fire test, and the best lubricating oil in the world; and that he intended to sell out his interest in the Standard, and erect new works of his own. In September, 1867, he brought to witness drawings of his retorts, machinery, pumps, &c., and samples of his products, which he left in a box with Mr. Lombard, which box had been in witness' possession ever since, and is produced in evidence.

We shall refer hereafter more at length to the evidence of Mr. Lombard in regard to the specimens of Tweddle's oil left with him, when we come to speak of the testimony of other witnesses as to the existence and use of the neutral topaz oil prior to the date of Merrill's alleged invention.

This project of forming a company fell through, owing to the serious injury of Mr. Lombard in the railroad disaster at Angola, N. Y., in December, 1867.

In the fall and winter of 1867–8, Dr. Tweddle enlarged his works, adding two large vacuum stills, besides a good deal of other apparatus (p. 171, ans. 128).

These stills were an improvement upon the cast-iron stills already in operation at his works; a model of them is shewn in Exhibit No. 35. They were like what he now uses for making his product, including his neutral topaz oil (p. 172, ans. 131), and also like the apparatus described in his patent of December 10, 1867.

On 22d November, 1867 (see Exhibit No. 70*a*), Dr. Tweddle made application for a patent for his improved stills in course of erection at his works. This patent was granted on 10th December, 1867 (p. 545). It will be referred to more at length when we come to speak of the subsequent patent granted to him in 1870.

While Dr. Tweddle was engaged in putting up his new apparatus in the Eclipse Works at Sharpsburg, that is, from October, 1867, to May, 1868, and until it was put into operation, he manufactured but little oil, and therefore did not use his cast-iron still (the first one) much during that period.

This brings the history of Dr. Tweddle's operations in the manufacture of oil down to 22d November, 1867, when he filed his application for his patents, which were granted to him on 10th December, 1867; and it must be noticed that all these operations were prior to the day (29th November, 1867) when Merrill testifies that he met with the accident to his still which led to his making the invention described in his patent of 18th May, 1869, on which this suit is brought.

Merrill, p. 51, ans. 12.

We think, however, that it is abundantly evident from the testimony that Merrill did not discover the cause of the effect produced in the oil in his still by the accident until several months later, as we have already seen.

In May, 1868, Tweddle got his new apparatus in operation, consisting of two stills, such as described in his patent of December 10, 1867.

The operation of these stills is described in his testimony (p. 211, cross 188). They were used either together, as described in his patent, or singly (p. 233, ans. 222–255), for making burning oil, neutral topaz oil, and heavy residuum or eclipse lubricating oil. The neutral topaz oil, as it came from the still, had paraffine in it (p. 212, cross 191). The paraffine was pressed out in the usual manner.

These stills, in conjunction with the first or cast-iron still, he continued to use in the same way from May, 1868, until 28th June, 1870 (p. 212, cross 189, 190).

In the summer and fall of 1868, Dr. Tweddle erected presses for expressing the neutral topaz oil from the paraffine, the pressure being given by hydraulic jacks (p. 202, cross 91, 94). In the spring of 1869 he erected a hydraulic press for that purpose (p. 203, cross 106), and freezing-house (p. 209).

Most of the neutral topaz oil which he sold and gave away to be tested in 1867, had the paraffine in it excepting a small quantity which was expressed on a small scale after freezing it (p. 209, cross 163; and Clarke, p. 282, ans. 60).

In the fall, winter and spring of 1867–8, Dr. Tweddle erected three vacuum stills at the Aladdin Refinery like the new stills at the Eclipse Works of Brereton & Wilkins. These stills were ordered in September, 1867 (p. 204, cross 118; Clarke, p. 289, cross 73).

On these stills Clarke, formerly foreman of Tweddle, then in the employ of Brereton & Wilkins, made neutral topaz oil all the time he was there (p. 289, cross 76, 78).

On the 18th December, 1868, Dr. Tweddle made his application for another patent, which was not filed, however, until January 26, 1870 (see pp. 497–8), which patent was granted to him on February 15, 1870 (p. 445).

During the summer of 1868, Dr. Tweddle stored up about five hundred barrels of his neutral topaz oil, and continued his manufacture of neutral topaz oil in the same manner until 28th June, 1870, when his Eclipse Works were utterly destroyed by fire caused by lightning (p. 172, ans. 133).

He then removed to the Aladdin Works, formerly of Brereton & Wilkins, where were stills erected by himself like those which he had used at the Eclipse Works, and where he has continued manufacturing neutral topaz oil in the same manner as he had done since May, 1867, at the Eclipse Works, from that time to the present day.

This suit was commenced, however, prior to the fire of June, 1870, and his removal to the Aladdin Works.

Evidence to prove the existence and use of Dr. Tweddle's neutral topaz oil prior to the date of Merrill's alleged invention.

We have already referred to the testimony of Dr. Tweddle and of

his foreman, Joseph Clarke, to the fact of the manufacture by Dr. Tweddle of heavy lubricating oil like the neutral topaz oil now manufactured by him at his Eclipse Works, prior to September, 1867, by the same process as he now employs. We have also shewn by the testimony of Dr. Tweddle, that he manufactured just such oil on a small scale at the Standard Works, in the years 1864 and 1865. We therefore shall not repeat this evidence, but confine ourselves to the proofs of witnesses who have seen, and of others who have seen and used, Dr. Tweddle's neutral topaz oil prior to November, 1867.

Wm. H. Howard, a dealer in petroleum lubricating oils, states that he purchased and dealt in Dr. Tweddle's neutral topaz oil for the purpose of compounding with fatty oils for lubricating purposes (pp. 251, 252); that the firm of James Dalzell & Sons, with which he was engaged, had tried other paraffine oils without success, as they were objectionable on account of colour and smell. He states that he first saw the neutral topaz oil in the fall of 1867, shewn to him by Dr. Tweddle at his works near Sharpsburg bridge. That these works were incomplete at the time, the carpenters being engaged in putting up a building.

He says that this oil was the same, to all practical purposes, as the neutral topaz oil now in market. That it was topaz colour. That he then told Dr. Tweddle that almost any quantity could be sold, mostly for compounding purposes. That at or about that time he took samples to try it, and the result was favourable. That the firm purchased this oil in the summer of 1868, and mixed it with fatty oils (p. 253), and that they continued to purchase to the time he gave his testimony (June, 1871). That in the summer of 1870, when Dr. Tweddle's works were burned, he tried to get other oil to supply its place, but did not succeed in getting any as good. That samples of oil which he heard called "Merrill oil," from Corry, were left with him, but the colour did not suit and he did not buy — it was too blue. That the Tweddle oil was from 34 to 38 degrees gravity, and that he sold it mixed with fatty oils for cotton-mill machinery (p. 254).

He fixes the date of the fall of 1867, when Dr. Tweddle first

shewed him the neutral topaz oil, by the fact of the residence of his uncle and grandparents in the neighbourhood of the Eclipse Works at that time (p. 255).

Archibald Kelly (p. 261).

For five years prior to January, 1868, was in the oil-refining business by the old process of fire under the still.

He lived on the property where the Eclipse Works were built, near the Sharpsburg bridge, sold the property to Dr. Tweddle in October, 1866, but continued to live in the house until March, 1868.

Dr. Tweddle commenced building his tank for storing crude oil in December, 1866; he went on immediately and put up machine-shop, still-house, tanks and boilers. Put up a cast-iron still in the spring of 1867, and in the summer or fall of 1867 he built his warehouse (p. 402).

The still was a round still, with gas-pipes all through it, operated by steam and superheated steam (p. 262). Dr. Tweddle used an air-pump for creating a vacuum for distilling. He commenced using this still with vacuum pump and superheated steam in May or June, 1867.

Witness observed the products of distillation, and there was none of that blue tinge that there is in the usual process (p. 403). The burning oil came over first, of the usual colour, except that it had none of the green tinge. Then an oil, which we called lubricating oil, of amber colour, a little milky when coming off the still. The residuum in the still was dark or dirty green (p. 262.)

Thinks there was no coke in the still.

This amber-coloured lubricating oil had a smell, but not the scorched, burnt smell like oils made by ordinary fire distillation. Attributes this freedom from smell to use of steam instead of fire. The amber-coloured oil got clear by exposure to the air (p. 265). Dr. Tweddle exposed it in large tanks. This oil witness used at his refinery as a lubricator for his pumps in 1867, and has used it since on a circular saw; it gave good satisfaction.

Dr. Tweddle pressed paraffine from his oil; the amber-coloured oil ran out when they pressed the paraffine.

Witness identifies a bottle of oil, marked "Exhibit 84," as being the same in smell and colour as the amber oil he referred to.

Robert Hill (p. 259).

Is proprietor of planing mill in Pittsburgh. In summer of 1867, between June and August, while he was making siding for Dr. Tweddle's warehouse at Sharpsburg bridge, Dr. Tweddle brought him some oil in a phial to try on his machinery (p. 260). Had been getting green oil from Dr. Tweddle previously; this oil he brought was of another kind; it was a light yellow. I called it machinery oil. Does not recollect whether he smelled it or not. Dr. Tweddle wanted him to try it on the fastest machinery he had. Witness told him they had faster machinery up-stairs in James Douglas' sash and door factory. Went up-stairs; saw him and Douglas going to the journals and putting the oil on. Thinks it was on the moulding machinery and circular saw they tried it.

Douglas told witness that he had been getting oil from different places before, but that this oil was the best he ever got (p. 260).

Witness had been getting Dr. Tweddle's green lubricating oil before; paid $10 to $14 a barrel. Never used any other kind from the Doctor — it was cheaper than the other kind. The yellow oil, witness thinks, Dr. Tweddle said was 80 to 85 cents a gallon.

James Douglas (p. 268).

Has sash and door factory in Pittsburgh; worked for Dr. Tweddle in January, 1867, until July or August, 1867, making sash, doors, &c., for his office and warehouse at end of Sharpsburg bridge.

Witness says (p. 268), —

> "Sometime from about the 25th of April to the 9th day of "May, 1867, he [Dr. Tweddle] came into the shop, and he "asked what kind of oil we were using on the machinery. I "told him we had been using different kinds of oil or from dif- "ferent parties, but we had a circular rip-saw that we had to use "lard oil on; the oil that we used on other machineries we could

"not use on the rip-saw; she run so fast that she burned out "the boxes. Dr. Tweddle said that he was making an oil that "he would like me for to try, but he brought me a bottle of oil "—a small bottle—a sample bottle. For to give him a fair "chance, I took the mandrel of the saw out to clean it and clean "the boxes, to give it a fair chance for to see if it would run "the saw, and I found that it suited the purpose as well as the "lard oil for the saw. I sent out afterwards and got either a "gallon or a two-gallon can of the same oil for to see if that it "would run the saw the same that the sample that he brought "me did, and I was satisfied that it would run the saw and all "the balance of the machinery. I sent after it was done for a "barrel, and we have used that oil ever since, when we could "get it. At the time that Dr. Tweddle's works was burned "down, we couldn't get no more of it for some time."

Witness fixes the date when Dr. Tweddle brought him the sample of oil to try, by the fact that when he came in, witness was working on the frames for Tweddle's warehouse, and the frames were delivered on 9th of May, 1867. Witness tried that sample before the frames were delivered; tried it on the mandrel and boxes.

As to the colour and smell of the oil, he says (p. 270) that he smelt to see if there was any benzine in the bottle the Doctor brought him; could not tell if there was any in it. If there was, it was a very light smell, if anything, scarcely any smell at all; but could smell that there was something in the bottle. It did not appear to be benzine.

It was a kind of a light yellow colour (p. 270).

Witness then examined a bottle of oil, Exhibit No. 85 (the same as referred to by James Douglas), and says, "I believe this to be the same oil. It has the same colour and smell, so far as I can see. It seems to be the same as we use at the present day" (p. 270).

C. Tiers Myers (p. 271).

Engaged in manufacture of material for washing wool.

In summer of 1867 was in Dr. Tweddle's Eclipse Oil Refinery. At that time the warehouse was incomplete.

When at the Doctor's works, in the summer of 1867, he shewed witness specimens of lubricating oils made from petroleum.

The dark oil was of a dark-greenish cast.

The light oil was yellow, lightish yellow, about the colour of sperm oil.

The dark was for railroad use.

The light was for use as a base oil, and for lubricating spindles, and general lubricating purposes.

The Doctor drew the cork of the phial of light oil, and remarked *there was no particular flavour about it;* hence its adaptability for general purposes. He spoke of his manufacturing that light-coloured yellow oil (p. 272).

Witness bought Dr. Tweddle's dark-coloured railroad oil for sale to railroads; it was what he termed Eclipse oil for railroad cars; it was quite dark, a rich shade of green. It is seemingly odourless; it had much less smell than crude petroleum (p. 273, ans. 12 to 16).

This witness could not be mistaken; he had dealt in Dr. Tweddle's oils both before and after that time, in 1866 and 1868, and from that time to the present (p. 273, cross 6).

Joseph Musgrave (pp. 460–462).

Had three years' experience, prior to October, 1867, in the manufacture and sale of petroleum oils at the Standard Works. Early in October, 1867, he saw oil of Dr. Tweddle's manufacture, which was nearly odourless, had little or no blue tinge, and was olive-coloured oil. The Doctor, afterwards (in October, 1868), frequently spoke to witness about his intention of selling this same olive-coloured oil for tanners and curriers' use. It must, therefore, have been heavy-gravity oil.

In further confirmation of the correctness of the dates at which this neutral topaz oil was seen by these witnesses, we refer to the testimony of Jos. C. George, the carpenter who erected the warehouse at Dr. Tweddle's Eclipse Refinery. He says (p. 258, ans. 6), that the warehouse was built in the spring, summer and fall of 1867.

Robert Hill says, that he was making siding for Dr. Tweddle's warehouse at Sharpsburg bridge, in the summer of 1867, at the time when the Doctor brought him some of this neutral topaz oil to try.

James Douglas, in like manner, fixes the time when Dr. Tweddle brought him this oil; he says, we were working on the frames for Dr. Tweddle's warehouse at the time, and these frames were delivered in May, 1867. He had the sample of oil before the frames were delivered (p. 269, ans. 14).

C. Tiers Myers fixes the summer of 1867 as the time when he saw these oils (p. 272, ans. 13), and that the warehouse was then incomplete.

L. L. Lombard. Dr. Tweddle tells us, that on the 16th or 17th of September, 1867, he took to L. L. Lombard, who was in the oil business in New York city, specimens of the products of his steam and vacuum process, viz., burning oil, neutral topaz oil, heavy green residuum and refined paraffine; his object being to interest Mr. Lombard in a company which Dr. Tweddle proposed to organise for carrying on his steam and vacuum distillation of petroleum at the Eclipse Works.

Tweddle, p. 173, ans. 137, 138.

Dr. Tweddle tells us that he then returned home on the 20th or 21st of September, and on the 23d of that month went to Cleveland. These dates are deeply impressed on his memory, because it was while he was absent on this trip to Cleveland that his dwelling house was destroyed by fire, on 25th September, 1867.

This project of forming a company fell through, owing to the serious injury of Mr. Lombard in the railroad disaster at Angola, N.Y., in December, 1867.

Mr. Lombard testifies (p. 274) that, in the fall of 1866, while Dr. Tweddle was yet at the Standard Works, he told him that he (Tweddle) had a patent for making oil *in vacuo*, and that he could

make kerosene to stand a much higher fire test, and the best lubricating oil in the world; and that he intended to sell out his interest in the Standard, and erect new works of his own upon a new process of refining. In September, 1867, he brought to witness drawings of his retorts, machinery, pumps, &c., and samples of his products, which he left in a box with Mr. Lombard, which box had been in witness' possession ever since, and is produced in evidence.

These samples were contained in five phials; of these, two bottles are missing, and the contents of one have leaked out, as follows: —

No. 1. Heavy green lubricating oil.
" 2. White kerosene.
" 3. Empty.
" 4 and 5, bottles missing.

Witness says that it was over two years (prior to November, 1871) since he discovered that two of the bottles were missing, and one was then nearly empty, and has all soaked out since. These bottles were packed in the box with newspapers, none of a later date than September 19, 1867, one of Pittsburgh, September 11, and another of New York, September 19, 1867, giving strong confirmation of the correctness of the date assigned to the transaction.

Witness says that one of the missing phials contained straw-coloured oil (p. 276, ans. 22).

Int. 23. What did you understand the one phial of straw-coloured oil to be?

Ans. At the time, I considered it a poor oil that would have to be bleached, but the Doctor then told me that it was not for illuminating, but was a lubricator, — what he called a spindle oil. What surprised me was its being *perfectly deodorised*, and yet of that dark colour.

Int. 24. State, as nearly as you can describe it, what colour the oil was which the Doctor called spindle oil.

Ans. As near as my memory serves me, it was a rather bright straw colour.

Int. 25. About what time in September, 1867, was it that

Dr. Tweddle left with you the box *Exhibit Lombard*, and the samples you have described?

Ans. It was the last of the month, about the last week in the month.

The box and remaining bottles are marked "Exhibit 86, Lombard." It is much to be regretted that the phial of neutral topaz oil should be lost, but the testimony of Lombard, who being in the business was not likely to be mistaken, is conclusive proof of the existence and character of the neutral topaz oil in the middle of September, 1867.

Samuel Downer.

We have further proof of the existence of this neutral topaz oil (of which Dr. Tweddle testifies that he had from 100 to 150 barrels stored at his works waiting until his presses were erected for expressing the paraffine therefrom), in the testimony of Samuel Downer, the owner of the works of which the complainant is, and then was, superintendent, and the manufacturer of Merrill's deodorised oil.

Mr. Downer tells us that he was in Pittsburgh from 3d to 11th March, 1868, and that while there, he on 7th March wrote a letter to W. B. Merrill, in which he says (see p. 401), —

"Tell Joshua [the complainant] one of his [Tweddle's] "numerous patents is dropping oil on pipes heated by super- "heated steam and running through a vacuum whilst being "dropped on. *I have seen his oil.* His products are naphtha, "12 per cent, about; illuminating oil, 63 per cent, about; "lubricating, about 5 per cent; residuum, 17 per cent; waste, "3 per cent; no alkali or acid."

These percentages, were given to him, not by Dr. Tweddle, but by Mr Gracie or Mr. Kier, in Dr. Tweddle's absence (see p. 401, ans. 9).

In another letter, written on 8th March, 1868 (p. 401), Downer says: "This 17 per cent residuum is very sweet, but without any

"shew of paraffine; was not liquid in the warm office, and is, the "Doctor says, very thick. If I understand him right, he drizzles oil "in a vacuum or [on] pipes heated by superheated steam, and this 17 "per cent of residuum is running out the whole time at the bottom. "His white oil, without acid or alkali, does not stink, but it has not a "marketable smell; that is a dodge nobody seems to have got hold of "but us. If he succeeds, there an oil factory is boilers for steam and "a vacuum pot. Lockhart thinks he will succeed." Mr. Downer proceeds to say, —

> "The samples were shewn to me; my attention was prin-"cipally directed to the illuminating oil, but I noticed both "the *lubricating* and the residuum. I feel quite confident "that the lubricating was *lemon-yellow colour*, partially chilled, "shewing paraffine crystals, with the usual still smell, and "somewhat thinner than the paraffine oils of commerce."

The white oil referred to was illuminating oil.

This testimony is strongly confirmatory; and, making due allowances for the fact that the latter part is merely given from recollection, and is not likely to be any too favourable to Tweddle, is proof that Dr. Tweddle had, previously to that time, manufactured by his process described in his patent of December 10, 1867, illuminating oils, and a heavier lubricating oil of light colour, and a heavy residuum, just as he states. As to the "still smell" of the illuminating oil, it will be observed that it was not treated with acids and alkalies, which would readily have removed that smell (see Merrill's dep. p. 521, cross 52), and that the paraffine in the neutral topaz oil was not expressed, the Doctor at that time not having his presses built for that purpose.

As the works were not in operation, or only very partially so, from October, 1867, to May, 1868, these oils seen by Downer in March of that year were almost certainly made by him prior to November, 1867; that is, prior to the date of Merrill's discovery of 30th November, 1867.

But this is not all of Mr. Downer's letter of 7th March, 1868; the

following extract from it was brought out on cross-examination (p. 405, cross 2) : —

> "I received yesterday yours of the 4th, and am very much "pleased to hear you speak so favourably of Joshua's *new lu-* "*bricator*, and hope it will prove all you expect, and that extra "exertions will be made to make it go everywhere ; *for on the* "*successful getting rid of our heavy products* I consider much of "our future success depends ; *but what the new lubricator is, is* "*beyond me*, for as yet I have never heard of anything beyond "the castor. So tell Joshua to write me *about what it is*, at "Corry, for which, *via* Oil City, I start this evening."

Thus we see that in March, 1868, Downer, the proprietor of the works of which Merrill was superintendent, and who evidently kept himself posted as to the matter of lubricating oils, had never even heard of Merrill's new oil. Does not this prove that although the accident to the still on November 29, 1867, may have happened, as stated, on that day, yet Merrill had not succeeded in repeating the operation, and had not been able to make the oil until a few days before March 4th, 1868?

Dr. Tweddle tells us that Downer did not mention Merrill's oil to him (p.178), ans. 176 ; and it is hardly credible that if Downer had ever seen or heard of Merrill's deodorised oil when he saw Tweddle's, he would not have spoken of it to him.

We submit that it is proven as clearly as it is susceptible of proof, that Dr. Tweddle's neutral topaz oil was produced and publicly introduced by him during the summer of 1867, independently of the direct testimony of Dr. Tweddle himself, and his foreman, Clarke, who assert the same fact, and that it was seen by Mr. Downer prior to the date of any actual invention by Merrill.

Patents granted to Dr. Tweddle for his method of distilling petroleum.

The method constantly practised by Dr. Tweddle in making his oils, including illuminating oil and neutral topaz oil, has always been the method described in his patent of 1862, and the subsequent improvements thereon.

These patents are,—

1. Patent of 4th February, 1862, pp. 539, 540.
2. Re-issue of patent of 1862, dated 27th November, 1866, pp. 542–545.
3. Patent of 10th December, 1867, p. 545.
4. Patent of 15th February, 1870, pp. 446, 448.

The patent of 1862, and its re-issue in 1866, we have already examined, and have seen that they prove distinctly that at their respective dates Tweddle described substantially the same process of steam distillation of petroleum under vacuum as that now used by him, and by which he makes his neutral topaz oil, and that they also state the result of such process in the production of light and heavy oils, substantially free from offensive odour.

We shall now proceed to examine the patents of 1867 and 1870, in their order, and shew the relation which they bear to his prior patents and to the present controversy.

1. *Patent of* 1867.

The patent of 1867 was applied for by Tweddle on 22d November, 1867, during the progress of the erection of his new stills at the Eclipse Works, and is evidently designed to describe the improvements he had made in his apparatus and process. It must not in fairness be considered apart from his former patent of 1866, because it is in the same line of invention, and is based upon what is contained in the prior patent of 1866.

This patent of 1867 describes a process of distilling petroleum which embraces the use of a vacuum in the still or stills employed, the absence of fire heat, and the use of superheated steam as the means of vaporisation of the oil.

The use of this process necessitates the use of the process mentioned in the claims of the re-issue of 1866; that is, 1st, the distilling of hydro-carbon oils, such as petroleum, &c., under a vacuum or partial vacuum, by the use of steam for producing the vaporisation of the article to be distilled; and 2d, the use of superheated steam, in combination with the employment of a vacuum, or partial vacuum, for the distillation of petroleum, &c.

The patent of 1867 starts therefore at this point, and describes a modification of the process the distinguishing feature of which is, effecting the distillation by aid of vacuum and steam, with even greater rapidity than could be effected by the use of the apparatus described in his former patent. His object was, as he says in his specification, to secure "*an exceedingly rapid evaporation.*" The object of this rapid evaporation we will consider shortly. The means which he employed to effect this purpose were the employment of a series of pipes which were heated with superheated steam, and above each pipe a trough through which the oil ran into the still; the troughs being perforated so as to allow the oil to drop on to the heated pipes over serrated plates, so that the oil gathering on the points of the serrations would fall in drops exactly on the heated pipes and pass in a thin film over the surface. The effect of this would be that the oil would be vaporised at once, and the vapour thus formed being drawn off immediately, by means of the vacuum, the distillation would be, as the specification states, exceedingly rapid. It is thus expressed in the specification:—

> "The drops or streams of oil, coming in contact with and passing over them [the heated pipes], are subjected to the action of a heated surface relatively large, which causes it to *volatilise* with great rapidity, the more so as the pressure of the atmosphere is already removed from the inside of the still by the air-pump. Fluids in motion, also, as is well known, vaporise more readily than fluids at rest; so that by causing the oil to flow over heated surfaces in a vacuum, *I secure an exceedingly rapid evaporation.*"

This is one feature, and an exceedingly important one, of this invention, because it effectually prevents the decomposition or cracking of the oil by vaporising it rapidly and pumping off the vapours by an air-pump, so that they are prevented from condensing and returning again to the still, as is the case where cracking is practised.

The oil, which is of heavier gravity than that which was vaporised, drops down to the bottom of the still, and runs out by a pipe to a second still, which it enters, and in which it runs through perforated

troughs and on to a series of pipes heated by superheated steam, hotter than the pipes in the first still. In this second still the next heavier grade of oil is vaporised and removed from the oil, and the unvaporised oil drops down and out through a pipe to a third still, and so on, according to the number of separations which it is desired to effect.

It will be seen from this that the controlling idea of the whole specification is to take out from the oil in each successive still a grade of oil of heavier gravity than was vaporised in the preceding one, and that this result would be defeated if the degree of heat employed in the first still were excessive, or so much as to break up the oil into thinner gravities. On the contrary, the very object and purpose of the invention is to secure a more perfect distillation or fractional separation of the oil into its constituent parts of varying gravity in a regular descending series.

There is, however, a second feature of this invention, in which Dr. Tweddle takes advantage of the fact stated by him in his specification, that "heavier oils require for that purpose [vaporisation] a "greater degree of heat," to secure his object of separation of oil into different gravities.

He passes his steam *first* through the pipes in the *last* still in which the last separation of the heaviest oils is effected, and then passes the same steam, reduced in its heat by the work it has already performed, to the next still, and so on from still to still; or, to quote the specification, —

> "I secure a continuous and complete distillation of hydro-"carbon oils, by vaporising the lighter ingredients with a *com-"paratively low* degree of heat, the *next heavier* ingredients by "a higher degree of heat, passing the residual oil for that pur-"pose *from still to still*, so as to subject it to a constantly in-"creasing temperature in the successive stills till only the resi-"duum remains."

Here, then, is the invention as regards heat; without requiring any manipulation of the apparatus, or the fresh admission of steam at the different stages, which would require the operator to watch

for the change in the appearance and gravity of the oil and then increase his heat, the process works of itself; the oil unvaporised in the first still (in which is a *low* degree of heat), passes to the second, where it meets a higher temperature, and so on in succession through two or *more* stills. It is an apparatus and process exactly adapted to the production of the largest quantity of neutral topaz oil with the least possible amount of decomposition, by rapidly separating the various grades of oil at the heat at which they relatively vaporise.

This patent does not mention the specific products obtained by the use of the apparatus and process described, and this is referred to by Mr. Merrill in his testimony. We submit, however, that this was not only not necessary, but would have been improper. The invention, although particularly designed by Tweddle to be used in distilling petroleum, is applicable also to distilling other hydro-carbons, of which there are a large number; and the products would be different according to the crude article distilled. Besides, the apparatus is adapted to any degree of fractional distillation, that is, the division into oils of any desired degree of gravity; and hence the products may be, and would be, as numerous as the number of stills employed, and vary accordingly; and it is required of a specification that it should contain as little as possible beyond the specific features intended to be claimed, and so much only of any description beyond that as is necessary to make it intelligible.

That the production of various products differing in gravity is stated as the result, is manifest; and that if used as stated in the specification, it would produce neutral topaz oil, is equally clear, because the inventor says he vaporises the lighter *ingredients* with a comparatively *low* heat; the next heavier by a higher degree of heat, passing the residual oil *from still to still* till only the residuum remains. The descriptive part of the specification describes the use of three stills, B, C and D; now if B were used to distil off the benzoles, and C the burning oil, what would be distilled from still D? Neutral topaz oil only would be the product.

It certainly is a great perversion of the language of this specification to say, as Mr. Merrill does (on p. 428), that in the specifica-

tion of 1867 a *high* and constantly increasing degree of heat is described; on the contrary, the specification says, that the lighter ingredients are vaporised by a "comparatively *low* degree of heat; the "next heavier, by a higher degree of heat," &c.

It is admitted that with the use of superheated steam, especially when in connexion with vacuum, the distillation is practically effected at a lower heat and with less decomposition than by the use of fire; hence the specification describes it as a "comparatively low heat." Merrill says, —

> "Steam used during the distillation is *a powerful preventive* "*of cracking*, and brings the oil vapours over at a much lower "temperature than is the case when fire distillation alone is re-"resorted to" (p. 513, ans. 15).

And Hayes, comparing the effect of the different methods by fire alone, fire and vacuum, fire and steam, and fire, steam and vacuum, says (p. 528, ans. 20), —

> "The minimum of cracking when distilling crude petroleum "is obtained when using fire, steam and vacuum."

He does not seem to have tried steam and vacuum *without fire*, which is the process always used by Tweddle, excepting occasionally when his superheaters were out of order; in which case he used steam and vacuum, and for the additional heat used a fire from a benzine pipe.

But that practically a very high degree of heat was not made use of in these stills, is admitted by Merrill, who says, in reference to the two new stills at the Eclipse Works (which were constructed in conformity with this patent of 1867),—

> "The stills, as described, at the Eclipse Works of Dr. Twed-"dle at Sharpsburg bridge, were admirably adapted for carry-"ing on the distillation of petroleum without the formation of "tarry matter or coke; as, in the manner described of the "working of that apparatus, it would be exceedingly difficult, if

"not impossible, to carry the distillation on sufficiently far to "produce a deposit in the stills of tarry matter or coke" (p. 416, ans. 12).

Mr. Merrill's testimony in regard to Tweddle's patent of 1867 is very remarkable. He seems very soon to have forgotten his admission in regard to the stills at the Eclipse Works just quoted, and attempts to make out that Dr. Tweddle contemplated the use of a very high and destructive heat in them. He says, that the comparatively low heat is to be applied only to distillation of the volatile products which come over before the burning oils (p. 424, ans. 32); but he forgets that the specification says that the petroleum to be distilled is put into the still "either crude or deprived of its gaso-"line or other more volatile ingredients," and that Tweddle tells us he had, in 1867, a separate still for removing these more volatile bodies (cross 85, p. 201).

Again, on page 428, ans. 42, Merrill says,—

"The oils produced in these stills, which are condensed in the "separate receivers, would vary in gravity, and the illuminating "oil, free from volatile and dangerous ingredients, would be "produced in the *second* of the series of stills as described, or "in the *last* if more than two were used."

This statement is too absurd to need much comment. It could not possibly be true if more than two stills were used, because, supposing the benzole to be condensed from the first, and the process were carried on through one, two or more stills, certainly there would be condensed in the *last* still something heavier than burning oil. It could not possibly be otherwise, unless the distillation were purposely arrested, when the gravity of the distillate became too heavy for illuminating oil. Such a statement as is contained in this answer, and the statement which he makes in reply to the 31st question, on page 423, that Dr. Tweddle's oil and his (Merrill's) oil are "both treated *precisely in the same way* and for the same purpose," are so utterly reckless as very much to impair any confidence

that might otherwise have been reposed in his testimony as an expert.

Another example of his "expert testimony" is worthy of notice. Dr. Tweddle says, in his specifications, that his "process of distilla-"tion obviates the necessity of *refining* the oil." Now Dr. Tweddle, as this witness says, uses the term "refining" to mean purifying, and here, no doubt, applies it to the purification by chemicals, although *now* it has a different meaning in the trade, and is appropriated to burning oil. Now in reference to this statement of Dr. Tweddle's, that he obviates the necessity of refining, Merrill says (p. 425, ans. 37) that, assuming that he had done the same thing with lubricating oils, "he would not have thus produced neutral topaz oil, or my deodor-"ised oil, but the product would have been an oil with the general "characteristics and associated odours of volatile oils that are pre-"sent, and are associated with the heavy paraffine oils refined with "acids and alkalies, such as were common in the markets before the "introduction of my deodorised oil."

Thus says Mr. Merrill; and surely it is a very expert answer; the whole force of it, perhaps, lies in the little word "*thus*." If he means to say, that if Tweddle *only* removes "the still smell," and does no more than that, he does not therefore make deodorised oil, if it has the more offensive smell of fire-distilled oils, then it is a mere truism; but the answer is apparently intended to *imply*, what it does not distinctly state, that Tweddle's oil made by this still would not be free from the more offensive odours referred to; whereas there is not a particle of proof that it ever had any such smell.

2. *Patent of* 1870.

This patent was put in evidence by the complainant.

On the 17th December, 1868, as we have seen, Dr. Tweddle prepared his application for his patent which was granted on February 15, 1870. His application was not filed until 26th January, 1870 (see file wrapper, Record, p. 497). The specification states that the invention relates to the distillation of petroleum and other hydrocarbons which can be made to yield a considerable amount of paraffine.

There are three claims: 1st, the process of producing paraffine; 2d, the neutral topaz oil as a new article of manufacture; and 3d, the use of vacuum, steam *and fire* in the distillation of petroleum.

If we examine the specification we shall see that there is no special form of apparatus described as necessary for the process referred to.

He refers to the fact that "since the early history of oil distilla-"tion, a *fire heat* of high temperature has been commonly applied to "the outside of the still." He is here evidently referring to the modes of distillation practised by others than himself, as he never himself used a furnace under his stills. He then proceeds to describe the ordinary process of cracking for decomposing the oil and converting it into the largest amount of illuminating oil; and here again he is evidently speaking of what others had done, and not to any vacuum process previously used by himself.

He then speaks of the rapid distillation of the residuum by *fire heat*, and of the offensive odour and blue colour given to the oil by this means.

He then proceeds to describe his process, which, he says, is *the reverse* of that before described; and his process is briefly stated in the words of the specification as follows: —

"I distil with a comparatively low heat, produced by free steam, "superheated or not, at pleasure, in a vacuum or partial vacuum, with "or without a fire on the outside of the still; by which means I am "enabled to produce paraffine in large quantity and a superior qual-"ity of lubricating oil, both of which are of marketable quality and "in fit condition for use, requiring but little further treatment."

He then states that the oil deprived of its lighter ingredients, benzine, &c., is admitted into a *vacuum still* so constructed as to permit the vapour of distillation to pass or be drawn over without condensing before leaving the still. He also states that the steam is admitted through a perforated pipe into the still in which a nearly complete vacuum is kept up.

The process is simply that the distillation is carried on until the distillate reaches a gravity of 37° or 38° Beaumé, when, the receiver being changed, the distillation is continued with a comparatively low

heat, so that the heavier products shall not be decomposed, which is continued until the yield of paraffine vapour ceases.

In order to prevent the paraffine from clogging the apparatus, the condenser is to be kept warm.

The apparatus herein described, so far as there are any details, is exactly that of Tweddle's patent of 1862, re-issued in 1866. We have a vacuum still, and vacuum apparatus, pipes for admitting the steam, and a condenser. So far as the process is concerned, there is nothing different, excepting that it is specific as to the gravity of the burning-oil distillate. As to the comparatively low heat, that is precisely what he describes as the efficient cause of the prevention of destructive distillation in the patent of 1862. As we have already seen, we have in all three of Tweddle's patents, the patent of 1862, re-issued in 1866, the patent of 1867, and this patent of 1870, the following elements: —

Distillation *in vacuo*.
Distillation by heat obtained from steam.
Use of superheated steam.

And whenever these concur, as we have seen, distillation takes place at "comparatively low temperature;" that is, as compared with distillation under atmospheric pressure. And we have also seen that in all cases of fractional distillation the heat required for distilling the heavier grade of oil is higher than that required for carrying over the lighter grades.

It will be remembered that Tweddle applied for his patent of 1867 before he had got his new stills in operation, and before he had expressed his paraffine from his neutral topaz oil except in small quantities. When, however, he started his enlarged apparatus in May, 1868, and, thenceforward during the summer of 1868, he accumulated about 500 barrels of neutral topaz oil in addition to the 100 or 150 barrels he had on hand in September, 1867 (p. 229, ans. 197), and finding that his paraffine was so abundant in amount and fine in quality, he may well have supposed that at that time, December, 1868, he was entitled to a patent for his process as a mode of producing paraffine, and for his neutral topaz oil, which at that time,

December, 1868, had not been in the market for over two years. But we are not concerned now as to that question; the only matter of importance in this suit as relates to this patent, is, that in December, 1868, he states that he had, previously to that date, already introduced his oil into commerce under the name of neutral topaz oil. The significance of this statement, made on the 18th December, 1868, is, that this oil which he first called by the name of neutral topaz oil in the fall of 1868, must have been made prior to that time, and in the apparatus in use at the Eclipse Works, either the cast-iron still or the two new stills, or in all three of them, which, therefore, must have been used, as he swears they were used, in such manner as to produce neutral topaz oil.

Examination of Evidence adduced by Plaintiff to Discredit the case made by Defendants.

The plaintiff has endeavoured to discredit the proof of the existence and public use by Dr. Tweddle of his neutral topaz oil prior to the alleged discovery by the plaintiff of his method of deodorising heavy hydro-carbon oils, by attempting to prove, —

1. That Dr. Tweddle could not furnish such oil as his neutral topaz oil at the time when he says he made it, between May and September, 1868.
2. That with the apparatus and process used by Dr. Tweddle from May to September, 1868, he could not produce his neutral topaz oil.
3. From the alleged silence of Dr. Tweddle in his patents and printed publications as to his neutral topaz oil.
4. From supposed admissions in the specifications of his patents of 1870.

We will consider these in their order.

1. The principal evidence relied upon to prove that Dr.

Tweddle could not furnish his neutral topaz oil, during the summer of 1867, is his negotiations with the Lightfoot Company in 1867.

An attempt is made to shew that in the fall of 1868, *Dr. Tweddle, being applied to by the Lightfoot Company, for an oil for finishing leather, for which his neutral topaz oil was exactly adapted, professed himself unable to manufacture such an oil, and negotiated for the right to sell, under the Lightfoot Company's patents, Seccomb, Kehew & Thayer's paraffine oil, for tanners' and curriers' uses.*

These negotiations were opened early in August, 1868.

At that time Dr. Tweddle had on hand a large quantity of neutral topaz oil, from which the paraffine had not been removed; his presses, without which he could do nothing to remove it in warm weather, not having yet been built. He was also manufacturing, besides this and the illuminating oil, his heavy residuum or railroad oil.

The Lightfoot Company were selling to the licensees under their patents (which patents were for processes of treating leather by the use of heavy hydro-carbon oils of different gravities) three grades of oil, all made for them by Seccomb, Kehew & Thayer; viz., stuffing oil called "A;" finishing oil called "AX;" and oiling-off oil called "AAX." There does not appear to have been any material difference, for the purposes of this inquiry, between the two last. They were both oils having the general characteristics of the paraffine lubricating oils then manufactured by the old process. But the "A" or stuffing oil was a much *heavier* oil than either of the other two.

This "A" or stuffing oil made by Seccomb, Kehew & Thayer had been found objectionable because the paraffine oil it contained crystallised in cold weather and defaced the leather, besides leaving it impregnated with an unpleasant odour. It was a distillate, produced without vacuum.

The Vacuum Oil Company of Rochester, N.Y., had introduced a stuffing oil made by them with vacuum (an infringement of Dr.

Tweddle's patents, of which he notified them as soon as he learned the fact (p. 219, ans. 268; p. 373, ans. 34); and *it was without offensive odour or crystallisable paraffine;* and Toppan says (p. 372, ans. 16), it "had nearly driven our 'A' stuffing out of use. Not "being able to get the Rochester oil, set us to hunting for a substitute."

They had negotiations accordingly with Dr. Tweddle, beginning in August, 1868, which ended in their purchasing from him "during "the months of August, September and October, 1868, about a "thousand barrels of his heavy, dark oil," which they sold under the name of their *improved* stuffing oil (p. 375, ans. 43–46).

But it is asserted that at the same time they negotiated with Dr. Tweddle for oils like the "AX" and "AAX" oil of Seccomb, Kehew & Thayer, but which should be free from the objections made to that; viz., the presence of crystallisable paraffine and the odour; and that he professed himself unable to produce such an oil, tried to do so, and failed; and did not succeed until he sent *samples* to Boston in September, 1869, meanwhile making arrangements to sell Seccomb, Kehew & Thayer's oil.

To which we say, —

1. There was, in fact, no objection to Seccomb, Kehew & Thayer's "AX" and "AAX" oils, for the purposes of the Lightfoot Company.

2. Dr. Tweddle did not propose to sell Seccomb, Kehew & Thayer's oil.

3. He had, at the time of the negotiations with him, stored at his works a large quantity of neutral topaz oil with the paraffine in, which he was selling in the Boston market.

4. The alleged conversations between him and the Lightfoot Company people, in August, and later in 1868, in regard to his not being able to furnish finishing oil, did not occur substantially as stated by complainant's witnesses.

Of these in their order:

1. *There was, in fact, no objection to Seccomb, Kehew & Thayer's "AX" and "AAX" oils, for the purposes of the Lightfoot Company.*

As to the crystallisation of the paraffine, Toppan says (p. 383, ans. 79), "*that is a slight objection in that oil;*" and it must have been, for it only left white crystals on the leather, which could readily be rubbed off.

Winn, who is a Director in the Lightfoot Company, says (p. 395, ans. 8), that they *still find* the Seccomb, Kehew & Thayer "AX" and "AAX" oils the best they can get; and Thayer says (p. 451, ans. 6), that they have continued ever since to buy it. This, notwithstanding the fact that both Merrill's and Tweddle's oil had long been in the market.

The explanation is given by Winn (p. 395, ans. 10), "the prices "that we purchase them at compels us to purchase them, rather than "oils that are less odorous;" meaning that they are the best he can get without paying a higher price than he can pay to advantage (p. 398, ans. 49).

Thayer, the superintendent of Seccomb, Kehew & Thayer's manufacture (p. 451, ans. 3), says there was never, to his knowledge, any complaint made by the Lightfoot Company of their finishing oils.

2. *Dr. Tweddle did not propose to sell Seccomb, Kehew & Thayer's oil.*

Toppan says (p. 376, ans. 54), that Dr. Tweddle wished certain lots of their oil to be sent to his agents, whose names he concealed; and adds: "I am very sure that it was five barrels of the finishing "oils that he wished for his Chicago agent."

Thayer says (p. 391, ans. 8–10), that if any such order had been given it would have been given to him; and that no such order was given, or arrangement made, to his knowledge.

Tweddle was cross-examined upon this subject before any testi-

mony about it was introduced by complainant, and says (p. 214), that "a sort of verbal agreement" was entered into between the Lightfoot Company and himself in regard to the tanners' oil (the heavy dark-green oil); that he has an indistinct remembrance that the agreement embraced light-coloured paraffine oil; that he does not remember whether it contemplated the company furnishing him with such light-coloured oils, or his furnishing them; that he does not remember having any talk with any of the officers or agents of the company about their furnishing him with such oils, but cannot say that there was not such talk.

No contract appears to have been in fact made between the parties. There were attempts to get at one, and drafts of writings proposed on either side for the purpose, but without result.

In anticipation of a contract, Dr. Tweddle printed and put out circulars, samples of which will be found at pages 244–247. Several hundreds of them were distributed, but the tanners at the West had a prejudice against the oils for their purposes, and little or nothing was done in that line by Dr. Tweddle, except the supply of his heavy stuffing oil to the Lightfoot Company themselves, as before stated (p. 216, ans. 229, 230).

The attempt of the complainant is to make out that all these negotiations and preparations had reference to oils (so far as regarded light-coloured or finishing oils) to be furnished to Dr. Tweddle by Seccomb, Kehew & Thayer, with a view to give support to testimony of conversations of the Lighfoot people, in which, it is alleged, Dr. Tweddle admitted that he was not at that time (the autumn of 1868) able to make any better light-coloured or finishing oil than that of Seccomb, Kehew & Thayer.

These circulars on their face relate to oils of *Tweddle's own manufacture;* and it does not appear that any one, at that time, took exception to the fact.

Again, it appears that a draft of agreement proposed by the Lightfoot Company was carried by Mr. Lightfoot to Pittsburgh, shewn to Dr. Tweddle, submitted by him to his counsel there, conference had of the three, and a new draft made by Dr. Tweddle's counsel, which was taken back to Philadelphia and submitted by Lightfoot to his com-

pany, refused by them, and another draft made by them, which was never submitted at all to Dr. Tweddle.

Dep. of *Lightfoot*, p. 388, ans. 9–13.

If Dr. Tweddle ever really proposed to sell any oils under the Lightfoot patents except those of his own manufacture, it would appear in the draft of agreement which *he* offered. Lightfoot, on his cross-examination in Boston, being asked (p. 390, int. 8), "Where are the drafts of the agreement referred to by you as having been prepared and discussed at Pittsburgh?" answers, "I think they are here in this office."

This draft is not produced by the complainant.

We have called and examined the counsel of Dr. Tweddle, who drew it up, *George H. Christy*, Esq. He fixes the date as November 30, 1868. He produces his memorandum of the agreement as he drew it up, and it is printed on page 493, Exhibit 123. By this it appears that it was not only recited in the draft of agreement that Tweddle was himself manufacturing oils suitable for all uses under the Lightfoot patents, but it was provided that the finishing as well as the stuffing oil should be marked as manufactured by Tweddle.

Dep. of *Christy*, p. 490.

We are not furnished by the complainant with even the draft taken at Philadelphia by Mr. Lightfoot, that we might know authentically what the *Lightfoot Company* proposed.

They produce one witness (*Cobb*, p. 391), who says that in *conversation* with Tweddle at Philadelphia in September, 1868, "he was "desirous of selling the finishing oil made by Seccomb, Kehew & "Thayer, and we were also anxious that he should sell it, and he "agreed, or was to agree, if the agreement had been consummated, "that he would purchase the finishing oil of Seccomb, Kehew & "Thayer, and would pay us a royalty of three cents a gallon on all "the oil so purchased of them."

A private letter from Cobb, written from Boston, December 16, 1868, to Lightfoot at Philadelphia, is introduced (p. 392), *subject to our objection* (which we insist upon), in which letter he says: "The

"understanding with Mr. Winn and myself was, in accordance with "our conversation with Tweddle in Philadelphia, in September, that "he should procure the finishing oil of Seccomb & Co., at the same "price that the company pay them for it, we to have three cents "royalty from Tweddle on it, and therefore we do not wish in the "license to say anything about the finishing oil, nor is it necessary, "as the oil obtained of them will be already branded by the Seccomb "Company."

Mr. Winn (p. 394, ans. 4) says only that the arrangement was for Tweddle "to sell curriers' oil or oils for curriers' purposes, under "a license from the company at a fixed royalty," the amount of which he does not remember.

The letter of Cobb has no business in the record of this case. It was improper to offer it. But if it be considered as evidence, it will hardly help the complainant. For, granting that it was not desirable to mention in the license the finishing oil, because it was "to be "procured of Seccomb & Co." (although the reason for suppressing it is hard to see), it certainly was not desirable to state in the license that Tweddle was to *manufacture that oil himself*. This was done in his draft of agreement; whether it was so in the company's own draft, they have not allowed the court to see.

Tweddle expressly denies (p. 473, ans. 54) that any such agreement or proposition as Cobb refers to was made. He says, —

> "At the meeting referred to, very little was said *in my pres-*
> "*ence*. They were to make me a proposition, which they did
> "shortly afterwards in the form of an agreement which Mr.
> "Lightfoot brought to me, I think, to sign. It was objectiona-
> "ble. They may have brought or sent a second agreement, which
> "was equally so, when negotiations ended. It seems to me the
> "objection was that I should purchase these bright-coloured oils
> "through the Lightfoot Company, and as I was making oils
> "equally suitable, and would be able to have them in the market
> "shortly, it was objectionable that I should purchase them. I
> "think there were some other objections in regard to the
> "territory," &c.

3. *Dr. Tweddle had at the time of these negotiations a large quantity of neutral topaz oil with the paraffine in, which he was selling in the Boston market.*

This oil was free from all offensive odour, and, when he should get his presses finished so as to remove the paraffine, it would be freed from the objection of "crystallisable paraffine."

The evidence that he had this oil is, on the general question of his priority of invention, important; because if he did have it in the autumn of 1868, it could only have been produced in the cast-iron still.

The evidence (pp. 451, 452) that he did have it, comes from Thayer, of Seccomb, Kehew & Thayer, wholly disinterested parties. He produces from his letter-book a copy of letter to Dr. Tweddle, dated October 23, 1868, in which this passage occurs: "Will you please send us five or ten barrels of your lightest coloured and best "winter par. *lubricating* oil, at the lowest price you are willing to sell "(as sample)? If quality and price suit, we may be able to sell some "of it."

It will be remembered that the *presses* were set up in the early winter of 1868–9, and until they were set up, Dr. Tweddle could could not furnish "*winter* paraffine lubricating oil;" *i.e.*, oil from which the paraffine had been removed, so that it would stand cold weather. Accordingly he did not send the desired sample till the early winter of 1868–9, and we find the receipt of it thus acknowledged by Seccomb, Kehew & Thayer, in their letter of January 18, 1869: "We telegraphed you this morning that your sample of deo-"dorised oil was received, and requested you to *send immediately* "*twenty barrels.*"

Mr. Thayer goes on to say (ans. 14–18), that the oil referred to in these passages was "*the* neutral topaz oil;" that the paraffine had been removed from both lots; that before the order of October 23, 1868, Dr. Tweddle had brought a sample bottle of the oil to Boston, and Seccomb Kehew & Thayer had examined it; and he adds, —

"*The oil was the same as the neutral topaz oil of to-day. Mr.*

"*Kehew shewed me the sample, and told me I was nowhere in "manufacturing oil; and I took offence at it, and told him if he "could do any better than I, to go down to Salem and manufac- "ture the oil himself.*"

This transaction is inconsistent with the notion that Dr. Tweddle professed himself, in the fall of 1868, unable to furnish the finishing oil desired by the Lightfoot Company; *unless, indeed, he meant that he could not then, for want of presses, furnish them with oil which did not contain paraffine.*

On the other hand, the testimony of Thayer affords a striking confirmation of the testimony by Dr. Tweddle and his witnesses, shewing what he had done in the way of making neutral topaz oil at and before that date.

There is still another fact, which is not reasonably to be reconciled with the notion of Tweddle's inability to furnish the finishing oil in the autumn of 1868, or indeed (as Toppan's testimony, page 377, ans. 56–60, leaves it to be inferred) till the autumn of 1869.

The specification of Tweddle's patent of February, 1870, *which describes fully his process of making the neutral topaz oil*, although not filed at the Patent Office till January 26th, 1870, *was sworn to by Tweddle, December* 18*th*, 1868. See the oath on page 497 of the Record.

It is not credible that such an invention as is described in that specification was made after the sample ten barrels acknowledged by Seccomb, Kehew & Thayer, January 18, 1869, had been manufactured; nor credible, that if the invention was made before, he should have sent samples of any other oil than the neutral topaz oil described in that specification; but it is highly probable that the drafting of the specification had been preceded by just such a practical demonstration of the value of the process and its products as we shew took place, beginning in the summer of 1867.

4. *The alleged conversations between Tweddle and the Lightfoot people in August, and late in* 1868, *in regard to his not being able*

to furnish finishing oil, did not occur substantially as stated by complainant's witnesses.

These are conversations testified to in March, 1872, alleged to have been held in the fall of 1868, *three years and a half back.*

Moses F. Winn (page 394) says, he talked with Dr. Tweddle at Philadelphia in the fall of 1868.

> "*Int.* 8. If you said anything to him about the parties of whom "you procured your AX and AAX oils for finishing, and about "the qualities of the oils you procured of them, state what you "said to him, and what the Doctor said in reply, if anything. "*Ans.* In the statement made upon the mode of using the oils "we termed stuffing oils, AX and AAX oil, meaning three "grades of oil, that we recommended the use of those oils from "Seccomb, Kehew & Thayer, because they were the most free "from odour. I had before explained to him the great impor- "tance of having it so. *I think*, the Doctor says, you won't "be able to get any better oil than you get from them, in that "particular."

That is all he says of the matter now in question.

Edward W. Cobb (page 391), who was present at that interview, heard nothing of the sort, if we can so infer from the fact that he is not asked anything about it.

Benjamin H. Lightfoot (p. 389, ans 15), walking through the streets of Pittsburgh in business hours, had a conversation with Dr. Tweddle, which he thus reports: —

> "I said, that if we could get an oil as sweet as the stuffing "oil, which would be suitable for oiling off, it would be very de- "sirable. He said that he did not know as we could do any "better, for the present, than use the AAX manufactured by "Seccomb, Kehew & Thayer, but he thought he would soon be "able to make an oil of as light a colour as the AAX, and as "sweet as the stuffing oil."

This might perfectly well have happened, if we substitute the word "furnish" for the word "make." The Doctor *would* soon be able to furnish just such a finishing oil as they wanted, viz., when he got his presses up so as to remove the paraffine.

Charles Toppan (pp. 372–374) had a conversation at Pittsburgh, first with Dr. Tweddle's foreman, and afterwards with Dr. Tweddle.

As to the first, he says (ans. 26) that he stated that if they could get a finishing or an oiling-off oil as free from odour and as free from acids as the Rochester oil, and have it lighter coloured, to match their AX and AAX, it was just what the Lightfoot Company were after. [He did not tell Dr. Tweddle that, as will presently appear.] The foreman (ans. 27) "said he had no doubt they could make the vacuum "oil, the black oil; but the finishing oils, the light-coloured oils, they "*were not making.*" It will be remembered that Dr. Tweddle had then a large quantity of light-coloured oil, heavy gravity, stored away waiting for the completion of his presses.

Toppan says (ans. 34), he called next day and met Dr. Tweddle at the refinery, and was shewn by him all around the works. He says: "*I explained to the Doctor the object of my visit. I wished "to procure an oil as a substitute for the 'Rochester vacuum oil' for "the Lightfoot Carrying Oil Co.*" (Whatever then was said about the lighter oils was incidental, and there was no reason why Toppan should pay much attention to it.) He says the Doctor "looked over "the finishing oils, inquired about them particularly, and said he "thought he could make them also." Whether there was any talk about the finishing oils, is very doubtful, in view of ans. 35, where the only reason he gives for thinking that he explained to Tweddle the objections to Seccomb, Kehew & Thayer's finishing oil was that he "explained the objections to their A stuffing oil, our finishing oils "having the same objections that the A has in odour, and having been "treated with acids. I undoubtedly explained the whole thing to "him."

He afterwards says, ans. 48, that while he was in communication with Dr. Tweddle in the fall of 1868, "*he wasn't able to even shew "us anything that approached in quality or colour the oils that we were*

"*then selling as a finishing oil — our AAX oil. The Doctor was* "*very desirous to do it, but he never accomplished it.*" This is much too strong, in view of Thayer's testimony about the sample ten barrels of neutral topaz oil ordered by the letter of October 16, 1868, and in view of the fact that by December 18, 1868, the specification of Tweddle's patent of 1870 was drawn up and sworn to.

We now proceed to shew that Mr. Toppan never saw Dr. Tweddle at the refinery at all, and that almost all of the interview he describes is a mere delusion.

Joseph Clarke, Tweddle's foreman at that time, testifies (p. 492) as follows: —

"*Int.* 11. Mr. Charles Toppan, a witness for the plaintiff, "says that he came to the Eclipse Refinery, near Sharpsburg, "about the 3d of August, 1868, bringing samples of tanners' "oil, a dark-coloured and a light-coloured paraffine oil, and had "an interview, which he describes, with the foreman. Were "you the foreman there at that time, and do you recollect his "visit? *Ans.* I was the foreman. I do recollect a visit of a "gentleman about that time. I didn't know his name. *He* "*brought the samples. Int.* 12. *Did he leave the samples with* "*you, and afterwards get them again? Ans. He did. Int.* 13. "He says that you carried him through the works, and shewed "him what refined oil you had on hand. Is that true? *Ans.* "It is not true. *Int.* 14. Did you carry him through the works, "or into the works at all? *Ans.* I did not. *Int.* 15. He says "that the foreman said that the light-coloured oils, meaning the "light-coloured oil like the sample he had with him, he was not "making. Did you say that to him, in words or in substance? "*Ans.* I did not. *Int.* 16. He says that he visited the refinery "again the next day, and met Dr. Tweddle there, and was car- "ried by him through the works. Was Dr. Tweddle at the re- "finery the next day? *Ans.* Not to my knowledge, he was "not. If he had been there I should have seen him. *Int.* 17. "Was this gentleman, whom I suppose to have been Mr. Toppan,

"with Dr. Tweddle at the refinery at any time to your knowl-
"edge? *Ans.* He was not."

Dr. Tweddle (p. 471, ans. 45) says, —

"Mr. Toppan is certainly labouring under a misimpression
"about seeing me at any time at my works; consequently I
"never took him through them. Mr. Toppan called at my
"works when I was absent. I believe I was at Smith's Ferry
"on that day. On the morning after he called I had to go to
"the city, and he called again at the works when I was away.
"He was, I understood, angry because I had not remained to
"keep the appointment which he himself made the previous day.
"He called at Mr. Kier's office in Pittsburgh after his return
"from his second visit to my works, but I was absent. On
"learning that he had called I went to the Union Depot Hotel
"to find him. I saw him either then or shortly afterwards, and
"went to his room with him. *Int.* 46. Did you ever carry
"him through your works, or shew them to him at all? *Ans.*
"Never."

Mr. Toppan describes the route he took when he was shewn through the works. We produce a drawing, Exhibit 122, shewing the plan of the works, and shewing that Mr. Toppan could not have gone where he says he did. He probably had in mind the impression he got from a glimpse of the yard when he was there with the foreman. See depo. of Tweddle (p. 472, ans. 47) and depo. of Clarke (p. 493, ans. 18).

See also answers 48 and 49 of Tweddle, on page 472.

2. Secondly, in support of his position that the mode by which the neutral topaz oil has been made since the date of his alleged invention is not the same as the mode by which it was made before that date, the plaintiff undertakes to shew that the apparatus in which we prove the neutral topaz oil to have been made in 1867, used in the manner in which we

shew it to have been used, could not have produced the neutral topaz oil substantially which the defendants are sued for selling.

They say, —

1. That the cast-iron still put up in the spring of 1867, was constructed with an exceptionally high capacity for cracking, and therefore probably the heavy oil was cracked; and if it was, thin offensive oils must have been made in distilling the oil which we say was the neutral topaz oil.

2. That there was evidence in the cast-iron still itself that such cracking had in fact taken place.

3. That by introducing the oil in thin streams upon the pipes containing superheated steam (which was one of the ways in which Tweddle worked in 1867) there must have been cracking and production of thin offensive oils.

4. That the percentage of oils of different gravities which were obtained in the use of the cast-iron still in 1867, could not have been obtained unless there had been cracking of the heavier oils; and therefore that the neutral topaz oil obtained in the course of these distillations could not but have contained offensive thin oils.

First. As to the suggestion that the cast-iron still of 1867 was constructed with an exceptionally high capacity for cracking.

We suppose the height of the still to have not been exceptional, considering the circumstances. It appears that Dr. Tweddle, who has built and equipped more refineries than anybody else in this country, has always been in the habit of putting on to his stills higher domes and goose-necks than other refiners and builders (p. 488, ans. 10 and 11). But for reasons which will presently appear, we do not think it material to burden the case with measurements upon this subject. The value to the plaintiff of the comparative height of the cast-iron still, lies only in the supposition that it was

intended to facilitate cracking, with a view to shew that cracking was practised therein.

Mr. Atwood says (p. 360, ans. 10), "I find the still to be con-"structed for cracking with a very high capacity for that purpose;" and Mr. Merrill says (p. 430, ans. 49), "its construction was exceed-"ingly favourable for the destructive distillation of the heavier oils "into illuminating oils;" in other words, for cracking.

After these opinions were expressed, it was proved on the part of the defendant, that the cast-iron still was covered with brick on edge, its interstices filled with plaster, and had a coating of plaster over the brick from one and a half to two inches thick, for the purpose of preventing condensation (p. 468, ans. 28), this condensation being necessary to the cracking in question; also that it was the practice of manufacturers to leave the upper part of the still not covered with brickwork, but exposed where they desired to accomplish cracking (p. 455, ans. 14–16. See also p. 440, cross 15).

After this testimony was given, Mr. Atwood, being recalled, says that his judgment that the cast-iron still has a large capacity for cracking is not changed; because the cracking capacity *would have been* far too high for any ordinary distillation, had not a portion, and a very considerable one, of the surface been protected from exposure to the atmosphere. We submit that it is not probable that Dr. Tweddle constructed the still with a high dome for the purpose of cracking, and proceeded to brick it over for the purpose of preventing cracking; we therefore submit that he had no such purpose as is attributed to him.

Next, the plaintiff says that there were signs in the cast-iron still itself (which is still capable of examination in the place where it was disabled by the fire of June, 1870) that cracking had in fact taken place therein.

If cracking had been practised therein, there must have been a deposit in greater or less quantity, after each distillation, of carbonaceous matter in the bottom of the still, which would have required to be cleaned out before the next distillation (p. 360, ans. 8; p. 361, ans. 16; p. 367, ans. 28; p. 498, ans. 3; p. 465, ans. 17; p. 469, ans. 32).

This carbonaceous matter is known by the name of tar or coke, according to the density which it acquires at the bottom of the still. Dr. Tweddle says, "Since I commenced the Eclipse Works, early in "1867, I have never made one single pound of tar or coke" (p. 230, ans. 198). And Clarke, who was his foreman from the erection of the Eclipse Works until September, 1868, says that the stills were never cleaned out, did not need it (p. 284, ans. 98).

Cuddy, a refiner of long experience, well acquainted with the cracking process, examined the cast-iron still about the first of June, 1872, and found no indications of the cracking process having been used in it; and from his inspection of that still it is his opinion that the cracking process had not been practised in it (p. 457, ans. 30 and 33).

Dr. Tweddle says, —

> "It would have been impossible to have cracked oil in that "still; for the joints in the man-hole at the bottom were of "lead; in fact, all the joints on the still were made with lead, "and the temperatures used in the cracking process would melt "lead. When using a still with a vacuum, every square inch of "its surface is subjected to a pressure of fourteen or fifteen "pounds per square inch externally of the atmosphere, which, "of course, had the lead been melted, or even softened, the "lead would have been forced by the atmospheric pressure into "the still, and destroyed the vacuum by admitting external air; "and were a distillation in progress at such an elevated temper- "ature, an explosion would ensue in all probability" (p. 466, ans. 18).

But it appears that Abbott, a witness for the plaintiff, found a soft substance, which he calls "tar or moist coke," near the bottom outlet of the cast-iron still, and a "dry, hard, coky substance" in the bottom of the still, half a peck or more (p. 347, 348, ans. 55, 56); and upon the strength of this discovery, it is confidently stated as matter of opinion by the plaintiff and his experts, that these deposits were the results of cracking, and proved that cracking had

been largely practised in that still (p. 360, ans. 11; p. 516, ans. 30, last two lines).

Now, it appears that at the time of the fire which destroyed that refinery in June, 1870, there were some forty barrels of heavy oil, about 25° gravity, remaining in the cast-iron still. Speaking of this accident, Dr. Tweddle says, —

> "On that day there was no exit to the condenser to the still, "owing to the fact that the condenser belonging to it had been "used for the purpose of condensing the distillate from a new "vacuum still which I had just put in operation. *When the "fire took place the brick walls of the building were partly thrown "down on the still. The bottom connexions of the still were "either broken off by the walls or the roof falling in.* This oil "in the still escaped into a cavity in below the still, leaving, I "think, a small portion in. *A severe fire surrounded this still "for forty-eight hours, more or less*" (p. 465, ans. 18).

Cuddy says, —

> "I was present at the fire on the evening on which it occurred. "*The whole site of the works was for nearly two hours a sheet of "flame*" (p. 457, ans. 38).

Holler says, the lightning —

> "Struck the twenty-thousand barrel tank full of crude oil, "and burst it. *It struck it, and set it on fire, and the oil washed "everything ahead of it. The oil was on fire*, and set the dwell- "ing house of Dr. Tweddle and the warehouse on fire. The "whole works were burned. The clerk, Mr. Foster, was burned "up in his office" (p. 266, ans. 5).

Now, Dr. Tweddle says, that in his opinion the deposits found by Abbott and Merrill in the cast-iron still were among the effects of that extraordinary exposure to heat. He says, —

> "I presume that a portion of the oil remained in the still, and "was vaporised and decomposed by the hot stand-pipe, for at

"the top of the hemisphere on which the stand-pipe stands, I "observed a deposit like asphalt, hanging down in threads six "or eight inches long. Part of it had run down the sides of "the still in little streams, and formed small, irregular deposits "of coky matter. In all my experience in distilling petroleum "oils by the cracking process, I have never observed such a "deposit of asphaltum. In the ordinary cracking process, the "only deposit ever formed on the sides, top or stand-pipes of "stills is a certain carbonaceous matter readily brushed off. "Never in any case have I known asphalt or coke deposits at an "elevated portion of the still" (p. 465, ans. 18).

Mr. Atwood, Mr. Merrill and Mr. Hayes are all recalled (p. 503, ans. 26; p. 516, ans. 30; p. 527, ans. 15), and state their opinion that the deposit in question could not have been produced by the conflagration in question. We cannot think it worth while to consume time by working out the details of this discussion of experts on such a subject. We believe that the court will be of opinion that the conditions to which the still and the oil in it were exposed in that conflagration were too severe and too extraordinary to enable any experts to form a trustworthy judgment as to what sort of deposit it could or could not have produced.

We may here refer the court to what is elsewhere made a subject of more particular examination, the operations of Mr. Cuddy, who performed in one of the wrought-iron Aladdin stills, altered so as to embody the most favourable conditions for cracking attributed to the cast-iron still by the witness for the plaintiff, the operation of distilling crude petroleum, on the 6th of June, 1872, at the request of Tweddle. In this still he distilled twenty-five barrels of crude Franklin petroleum of 32 gravity. He occupied forty minutes in introducing this oil, the heating pipes being meanwhile filled with superheated steam, and he produced 25 per cent of burning oil as distillate in three hours from the commencement of the operation, and 55 per cent of neutral topaz oil in two and a half hours more, leaving a residuum of 20 per cent of heavy green oil in the still (pp. 481–485).

He put in evidence *three* samples of neutral topaz oil. No. 126 and No. 127 are samples of the neutral topaz oil manufactured by him the day before in the manner thus described. No. 130 is a sample of the neutral topaz oil *already* on hand at the Aladdin Works (p. 484, ans. 27).

Mr. Cuddy (p. 484, ans. 30) and Dr. Tweddle (p. 486, ans. 7) both say that there was no cracking in the production of the neutral topaz oil, Exhibits 126 and 127: they are both substantially free from *fluorescence*.

The three samples, Nos. 126, 127 and 130, were exhibited to Mr. Atwood June 20, 1872, in his cross-examination (p. 505, ans. 48, 51), and he was asksd whether he found any indications that, in the course of the distillation in which either of them was produced, cracking was practised or not, and he said that he could not tell whether it had been practised or not, that, judging from odour alone, he should think *all* those specimens had a small quantity of those volatile oils to which odour is mainly if not wholly due; that this last might have been produced with or without cracking; that odour was one of the indications that cracking had been practised; that he found "126 and 127 to be very similar, 130 slightly different, very little "difference: if any in amount, a slight difference in character." In regard to fluorescence, he said he did not think that to be an essential characteristic of cracking (cross 53). We suppose that it is, and that the absence of fluorescence shews that no decomposition or cracking of heavy oil has taken place. Upon this subject Mr. Merrill expresses the opinion (p. 511) that fluorescence is mainly due to a chemical combination of oil with a very slight percentage of water. Mr. Atwood says that he supposed it to be due to polarisation of light resulting from an unstable property in the oil, rather than any substance in it; and in answer to the 57th cross says, he does not know that he knows why it is that the ordinary paraffine lubricating oil of commerce, produced by fire distillation, has this property. In answer to cross 59, he says that fluorescence is a point to which he has paid very little attention in practical manufacture. Dr. Tweddle says (p. 174, ans. 143), "I "attribute it to molecular change in the construction of the oil, caused

"by the high temperatures which are used in fire distillation." We suppose that Dr. Tweddle's long and thorough experience in distillation, both with and without vacuum, entitles his opinion to more consideration than either that of Mr. Atwood, who has had no experience in vacuum distillation at all, or that of Mr. Merrill, whose experience is limited to experiments conducted since this suit began, and with a view to testimony.

On the whole, we submit that the result of Mr. Cuddy's use of the still, and production of the neutral topaz oil therein, as testified by him, furnishes a satisfactory, practical answer to the scientific reasoning offered by experts for the plaintiff, to shew that the neutral topaz oil could not have been successfully made in the cast-iron still, as Dr. Tweddle and his witnesses say that it was.

One of the reasons given by both Mr. Atwood and Mr. Merrill why the neutral topaz oil could not have been made in the cast-iron still used as Dr. Tweddle says he used it in 1867, without cracking or decomposition, and the production of thin offensive oils in the distillate, is that the oil introduced in thin streams dropped upon the surface of the pipes containing superheated steam, would be cracked or decomposed. Mr. Atwood says (p. 361, ans. 13), —

> "In allowing the oil to drip over the pipes, parts of the sur-
> "face would undoubtedly be bare, or nearly so, a portion of the
> "time, and become heated above the point necessary for distilla-
> "tion, and then a first portion of the oil would drop upon the
> "surface thus heated, and be decomposed by the high heat to
> "which it would be subjected."

Mr. Merrill says (p. 416, ans. 12), —

> "In the case of the cast-iron still, where the products of dis-
> "tillation were carried to so great a height in the form of vapour
> "before they passed over to the condenser, that condensation
> "against the surface of the dome of the still, and a consequent
> "falling back into the still of the oil so condensed and falling
> "upon the heated pipes in the still, would produce decomposi-
> "tion or cracking of the oil, in which case carbon, or coke, or

"tarry matter, would be deposited upon the dome or inside the "still."

These gentlemen, basing their opinions upon the assumption that the temperature of the outside of the steam pipes would be of a certain excessive height, assume the high degree of temperature for the exterior of the pipes, from the fact stated by Dr. Tweddle, that the main superheated steam pipe, at the point where it enters the still, is heated to a red heat; but it must be remembered that between this point and the upper series of pipes on which the oil drops, there extends a great length of superheated steam pipe, in which the temperature of the oil (supposing it to be as hot at entering the still as the red heat of the main pipe would indicate), is rapidly and greatly reduced. Upon this subject Dr. Tweddle says (p. 478, ans. 73),—

"In regard to the red-hot superheated steam pipe, it is not a "correct indication of the heat of the steam passing into the "still, for the steam is attenuated in its distribution in pipes, "and the temperature consequently reduced. Were the steam "pipes in the still at a red heat, they would rapidly be coated "with a carbonaceous deposit, and almost incapable of trans- "mitting heat. Did such action take place, distillation could "not be proceeded with. Asphaltum is an extremely poor con- "ductor of heat. To shew how incorrect a red-hot pipe is for "indicating the temperature of superheated steam, I mention "this fact, that if you take a large superheating furnace when "all the pipes are red hot, and you pass steam through it mode- "rately, you can secure good superheated steam. If you turn "on a large amount of steam, and allow it to pass rapidly out "of the furnace, your steam is imperfectly superheated, and at "the same time you will observe that the steam pipes leading "from the furnace will get red-hot gradually, further and fur- "ther from the superheated furnace, sometimes thirty or forty "feet distant, and the apparently superheated steam you have "been making is in reality imperfectly superheated."

It will be noticed, that the experts for the plaintiff base their

opinion that neutral topaz oil, free from offensive thin oils, could not have been produced in the cast-iron still in 1867, upon two grounds: first, the decomposition of the oil, as it fell upon the hot outer surface of the steam pipes; and secondly, the decomposition of the oil, by reason of the height of the still, "furnishing a high capacity for "cracking." The latter of these supposed difficulties must be at least as serious as the former, and it is to be observed that the decomposition or cracking from that cause (namely, the oil falling upon the hot pipes), would have nothing to do (as the cracking from the other cause might have) with the per cent of residuum in the still down to which the distillation was carried; but would, if the plaintiff's experts are right, prevent the successful manufacture of neutral topaz oil in *any* amount.

Now, the experts for the plaintiff, on this part of the case, encounter a difficulty in the fact that the wrought-iron stills in which neutral topaz oil was made continuously from May, 1868, down to June, 1870, long after this suit was commenced, had the same hot superheated steam pipes, with the oil introduced in thin streams, which dropped upon those pipes (only there was vastly more extent of hot pipe in that horizontal section of the still at which the still struck the pipes); and it would seem to follow that the experts for the plaintiff must be mistaken, in supposing that there would be any such decomposition of oil, from that cause, as would interfere with the successful production of neutral topaz. Now, if they are mistaken in their judgment as to the necessity of decomposition from that cause, we cannot rely upon their judgment in regard to its necessity from the other cause, to wit, condensation in the upper part of the cast-iron still on account of what they consider the excessive height of that still; and we submit that in view of the differences, such as they were, between the wrought-iron stills and the cast-iron still, and the fact that neutral topaz oil was successfully made down to June, 1870, in the wrought-iron stills (and for that matter, has been made in stills just like them ever since at Aladdin, and in the same mode of using them), there is no sound reason in the construction of the cast-iron still, and its use in the same mode, why the oil should not have been made therein.

The truth is, as we suppose from the testimony, that neither Mr. Atwood, nor Mr. Merrill, nor Mr. Hayes have sufficient knowledge of vacuum distillation of petroleum, on a commercial scale, to make the comparisons and state the judgments which appear in their testimony in regard to what could or could not have been accomplished by such distillation in the cast-iron still.

In fact, the reason why there is no decomposition or cracking of the heavy oil in distillation by the vacuum with superheated steam, which is Dr. Tweddle's method, and has been from the beginning, is that the vapours are formed at a temperature less than that which would decompose them by heat, and that they are swept away quickly into the condenser as soon as formed. It is the great rapidity of this removal of the vapours from the place where they are formed that explains their not being cracked or decomposed after they are formed; and it is precisely here, in their want of knowledge of the practical working of vacuum distillation upon a commercial scale, that the expert witnesses for the plaintiff have been led astray. The slow and, so to speak, reluctant removal of the vapour from over the oil in the still, when cracking is to be performed, is well shewn in Mr. Atwood's testimony on page 369. He there shews that a much longer time is required to distil heavy oil by cracking than to distil it over as heavy oil. He says (ans. 3), —

> "That portion of the oil that condenses in the top of the large "still and returns back into it, would have to be again redis- "tilled." "Only that which, by repeated redistillations, had "been cracked and changed until it could reach the top of the "still, could pass out."

On the other hand, Mr. Atwood says (p. 441, ans. 31), —

> "Vapours under the vacuum expand very much, so that the "amount of vapour necessary to fill a given space, while under a "partial vacuum, is very much less than the amount required "when under the ordinary pressure of the atmosphere; conse- "quently if a given amount in weight is to pass out of a still "under the vacuum in a given time, it will have to pass corre-

"spondingly more rapid than it would if under the ordinary "pressure of the atmosphere."

Dr. Tweddle, with more exact practical knowledge, states the same thing with more particulars. On page 466, ans. 23, when asked, —

"Why is it in distillation with the vacuum there is no crack- "ing and no deposition of coke?" he answers as follows: "Ow- "ing to the low temperature and the rapidity with which distil- "lation is effected, no decomposition takes place. The oil "vapours do not remain in the still and be subjected to redistil- "lation, as in the ordinary cracking process, but pass as rapidly "as they are formed into the condenser. The oil vapours are "also assisted in being removed by the currents of superheated "steam thrown into the vacuum still. The rapidity of their re- "moval may be conceived from this fact, that one occasion I "had in the tank some four or five hundred barrels of illumi- "nating oil which was accidentally discoloured by some crude "petroleum being let into the tank. I redistilled it all through "that vacuum still in about a day and a half, and made it a good "colour again. Atmospheric air flows into a vacuum at the rate "of about sixteen or eighteen feet per second, which will give "some idea how rapidly vapours formed in a vacuum still, rush "over to the condensers. It would have taken a still of the "same size under atmospheric pressure heated by fire, at least "four or five days to have effected the distillation which I effected "in the vacuum still in a day and a half."

Dr. Hayes says (p. 533, ans. 40), that the motion of mixed vapours of oil and steam in a still of twenty-nine inches vacuum towards the condenser and air-pump, would be *relatively* slow compared with that of air; and this we suppose may be true.

In further illustration of this point, we refer the court to the evidence of Dr. Tweddle (p. 467, ans. 24 to 26), as to the great difference between the extent of condensing surface required for vacuum distillations, and that required for distillation in atmosphere; and

with that, the court will take the criticism made by Mr. Atwood, speaking theoretically, on page 503, ans. 28.

There remains this significant fact, that although, as the plaintiffs would be disposed to insist, vacuum distillation of petroleum with superheated steam was merely the application of a known mode of distillation to a new subject, none of the refiners who have practised cracking for many years in various parts of the country to great extent, have ever, so far as appears, undertaken to use a vacuum still for that purpose. All that appears in this direction is by the testimony of Dr. Hayes (p. 530, ans. 30), where he describes the distillation of some Franklin petroleum in an experimental vacuum still; the still which is referred to in various parts of this book, and which is elsewhere shewn to have been extremely imperfect. In this distillation with this experimental still, Dr. Hayes says it was shewn that cracking *could* be effected.

3. The alleged silence of Dr. Tweddle in his patent of 1862, 1866 and 1867, and in the prospectus and circulars published by him in August, 1867, is adduced as proof that he had not then produced his neutral topaz oil.

We have already, in the examination of the patent referred to, shewn that, while Dr. Tweddle does not speak expressly of the specific products which he proposed to manufacture, he does speak of the peculiar results of his process which are the efficient cause of the production of his neutral topaz oil. That he speaks expressly of the advantages of steam and vacuum distillation, and among these mentions the odourless character of the distillate. The object of these patents was to describe the new process invented by him, a process applicable to the production of distillate of any desired gravity, and substantially free from offensive odour; and there can be no question that these patents protect him in the use of this process, and in the manufacture of any product which the process necessarily yields.

It was not necessary that the patentee should describe the peculiar character of the distillate at any particular stage in the operation, and we think it is clear that enough is stated as to the effect of this mode of distillation to shew that Dr. Tweddle, when he took out these patents, knew that they would produce just such an oil as the neutral topaz oil of to-day.

As to the circulars and prospectus published in August, 1867, we have already sufficiently commented on their alleged silence as to the neutral topaz oil, and have shewn that these also state the odourless character of the distillates, and that Dr. Tweddle has sufficiently accounted in his testimony for his not making any more specific mention of the neutral topaz oil as a result. We have shewn, moreover, that in the public experiment he then made he must have produced neutral topaz oil, as he states that he did, and that this product was run into the same receiver with the burning oil. Further comment is, we think, unnecessary. It would be impossible, we allege, to use the process described in the patents referred to, or in the public experiment made by Dr. Tweddle in August, 1867, without producing neutral topaz oil, if the distillation were continued beyond the gravity of burning oil.

4. Finally, the plaintiff seeks, as we understand, to use certain expressions which he finds in Dr. Tweddle's patent of 1870, as going to shew that he did not, in fact, make his neutral topaz oil in the year 1867 which he says he did, and in the way he says he did.

This patent is considered in another part of this brief more fully in its relation to the previous patents of Dr. Tweddle; and we refer to it now upon the single point above stated. On this point, its relevancy is in its being an *admission* of record by Dr. Tweddle. No question arises as to the validity of the patent. A statement is found in the specification under his signature which is of the same value as, and of no more value than, the same statement would have

been if made by him in a letter, or in a well-proved conversation. The expressions to which we refer are found on pages 447–8 of the Record, and they are as follows: "The almost entire absence of "the blue and yellow tint and odour renders the oil, *which I have* "*introduced in commerce as neutral topaz oil*, much more valuable "than the lubricating oils produced by distilling tar or petroleum, "or other hydro-carbon, by the first process hereinbefore described, "and in general use. *The lubricating oil thus described is a specific* "*product of this mode or process of manufacture, and cannot be made* "*in any other way*. By the qualities specified it is readily distin- "guishable, by any one skilled in the art, from all other lubricating "oils heretofore known to the trade." The date at which these statements were made is the date at which the specification was executed. By referring to page 497, it will be found that the specification was sworn to on the 18th day of December, 1868.

He is speaking, then, of a process which he had employed, and of an article which he introduced into commerce, before that date. Now, there is no evidence in the case that he had practised any process, or introduced any oil into commerce as neutral topaz oil, before that date, except the process practised in the cast-iron and wrought-iron stills at Sharpsburg bridge, and the neutral topaz oil which he had made by that process in those stills. This subject has already been fully discussed, and we think that we have already clearly shewn that the process described in the patent of 1870, so far as the production of neutral topaz oil is concerned, is substantially the same as that by which he made the same oil in the summer of 1867. We must interpret these statements in view of the proved facts of the case, with which there is certainly no necessary inconsistency.

It is true that he had introduced the oil in commerce as neutral topaz oil. He introduced it "in commerce" in the summer of 1867, and he introduced it further under the name of neutral topaz oil in the autumn of 1868 (p. 209, cross 165).

As to the statement that the neutral topaz oil "is a specific product "of this mode or process of manufacture, and cannot be made in any "other way," it will be said, perhaps, that this means that it cannot be made by the process described in the patent of December, 1867,

and by the witnesses who speak of his operations in the years 1867–8. Whether this is so or not, depends upon the interpretation of the specification as a whole in its relation to the previous patents Dr. Tweddle had taken, and to the history of his operations in vacuum distillation as a whole. We have elsewhere shewn that the narrow interpretation given by Mr. Merrill in his deposition to this specification of 1870 is inadmissible. There is but one other interpretation, namely, that he means by this "mode or process of manufacture," the mode or process of producing neutral topaz oil, and other products from petroleum, by distillation with superheated steam in vacuum. If this is what the statement means, we suppose it to be perfectly true.

The plaintiff has attempted, with what success we have seen, to discredit the defendant's proofs as to the mode in which Dr. Tweddle made the neutral topaz oil sold by him, but, as we before remarked, this is not sufficient to establish an infringement, for it rests with them, if they dispute Dr. Tweddle's statement, to prove affirmatively in what way he does make the oil in question.

As the plaintiff has not offered any evidence to prove, as a matter of fact, in what manner the neutral topaz oil is made, we shall briefly inquire, —

In what way does the plaintiff contend that the neutral topaz oil, sold by the defendants in this case, was in fact made by Dr. Tweddle?

It is not clear to us upon the testimony what they do believe or claim on this subject. On page 65, cross 27, Mr. Merrill being asked, "Do you know by what process Dr. Tweddle's lubricating "oil, which defendants in this case are complained of for selling, "is made?" says, "I do, if he follows his patent, which I have reason to presume he does."

We suppose this means the patent of 1870, interpreted as the plaintiff seems to interpret it, namely, as describing a process in which crude oil is introduced into the still in mass (the benzoles

having been first removed), and then the burning oils, and afterwards the neutral topaz oil, are removed by fractional distillation.

We have already shewn that Dr. Tweddle has practised this method of using his stills (introducing the crude oil in mass) very seldom, and have shewn what his regular and usual method has been.

It seems to have been suspected, at one stage of the case, by the plaintiff that Dr. Tweddle did not make his neutral topaz oil at all by vacuum distillation of crude petroleum, but that he put the paraffine oil of commerce, containing more or less offensive thin oils, into his still, and removed those offensive thin oils by vacuum distillation, leaving the deodorised oil as a residuum, which would have been an infringement of Mr. Merrill's patent. Thus Mr. Downer, writing to Mr. Merrill, October 2, 1868, says (p. 403, at the top), "I think "it will turn out, if you ever know, that he [meaning Tweddle] is "running paraffine oil instead of crude *now* through his vacuum su- "perheated steam apparatus." Mr. Downer's prediction does not appear to be confirmed by the testimony in the case.

There are then three hypotheses of fact, on one or the other of which the plaintiff may rely. One is, that Dr. Tweddle produces a neutral topaz oil by vacuum distillation, of offensive light oils from paraffine oils of commerce, leaving deodorised oil as a residuum. This is denied by Tweddle, and there is no evidence or reason to believe that such is the fact. Another is, that his neutral topaz oil has been made by the process which he himself describes as the true one, and which is really the process by which, upon the evidence in the case, his oil has always been made. The plaintiff, however, cannot put his case of infringement upon this hypothesis, because the proof is clear that this process of introducing crude petroleum gradually into a vacuum still and running it over pipes heated by steam, thus producing the neutral topaz oil as a distillate and not as a residuum, was practised in the cast-iron still in the summer of 1867, which is prior to the date of Merrill's alleged invention, and afterwards in the wrought-iron stills, and others exactly like them, from May, 1868, down to the present time. He must, we suppose, rely upon the only remaining theory that Dr. Tweddle has manufactured his neutral

topaz oil within the time covered by this suit, by introducing crude oil *in mass* into the still (first removing the benzoles), and then distilling off, first the illuminating oil, afterwards the neutral topaz oil, leaving heavy oil in the still as a residuum.

We do not know where the plaintiff finds his evidence that the neutral topaz oil has been so made. He will not pretend that there is any evidence that it is the only way in which the oil has been made within the time covered by this suit; and if it be true that neutral topaz oil has been made within that time in that way, *and others*, the burden is upon him to shew in which of the several ways it was in fact made; and this he has not undertaken to do.

But we will assume, as the assumption most favourable to the pretensions of the plaintiff, that the mode last described is that in which the neutral topaz oil complained of has been made. We will therefore, in the discussion of the similarity or difference between the Merrill and Tweddle processes as bearing upon the question of infringement to which we shall presently come, consider the process of Dr. Tweddle as having been the last-mentioned one, that being the assumption most favourable to the pretensions of the plaintiff.

First, however, we will proceed to state in what way the oil sold by defendants has actually been made.

The lubricating oil sold by defendants, and known in the trade by the name of "neutral topaz oil," was manufactured by Dr. Tweddle at his Eclipse Refinery near Sharpsburg bridge in Pittsburgh, Pennsylvania.

A specimen of this oil is shewn in complainant's Exhibit No. 13. It is stated by the plaintiff (p. 53, ans. 18), to have a gravity of 34° Beaumé.

The question of the identity of this oil with that of plaintiff we shall consider hereafter. We are now concerned only with the process by which it was made, in order that we may be able, when we come to consider the question of infringement, to institute a comparison between the processes of Tweddle and Merrill.

The process employed by Tweddle in manufacturing the oil sold

by defendants, is based upon principles peculiar to his mode of operation, and unlike anything previously practised in the art of petroleum distillations.

As we have already seen, in speaking of the state of the art, the ordinary mode of distilling crude petroleum was to place it in a still under atmospheric pressure, and by the aid of fire heat applied to the outside of the still to vaporise the oil, the vapours thus generated passing through a condenser and collected in a receiver as distillates. These distillates of fire distillation have a very offensive odour, caused, as is supposed, by the high temperature at which they are distilled. The heavy distillates, or lubricating oil, thus produced has a good colour, because it is purified by distillation from the separated carbon, but its offensive smell renders it highly objectionable. It is to the deodorising of such oil that Merrill's process applies, and, as we have seen, he effects this by placing this heavy offensive distillate in a still, distilling from it a small percentage, being the thin associated oils which it contains, and the residuum of this special distillation remaining in the still is his deodorised oil.

Tweddle, on the contrary, conducts his operation upon the theory that the disgusting odour peculiar to the distillates of fire distillation of petroleum, and generated by the decomposition of the oil, caused by the high temperature employed by the old process, can be entirely prevented by the use of a low temperature, lower than that at which distillation of petroleum can be effectively carried on under atmospheric pressure. He heats the oil in his stills with steam, increasing the heat, as required, by the use of superheated steam, and carrying off the vapours thus readily and rapidly generated, away from the influence of heat, by drawing them out of the still by means of a vacuum pump which keeps up a nearly perfect vacuum in the still, and this serves the double purpose of enabling the petroleum to vaporise at a lower temperature, and removing the vapours as fast as generated to the condenser.

This process is thus described in general terms by Dr. Tweddle :—

> Crude petroleum having been first deprived of its lighter ingredients, such as gasoline, benzine, &c., by steam distilla-

tion or otherwise, is admitted into a vacuum still, into which steam is introduced, and a moderate fire heat maintained outside, if desired. Distillation then proceeds until the illuminating oil has all been distilled over, the distillate at that point marking about 38° B. What remains in the still, instead of being distilled over in such a way as to produce decomposition, and consequently offensive light oils (to which distillate the Merrill process is applied, and from which it removes the offensive light oils by a second distillation), is distilled over in such a way that practically no decomposition takes place, practically no offensive light oils are produced, and the distillate requires no further distillation or treatment, except, perhaps, the slight chemical treatment common to all paraffine oil manufacture; frequently not even that. (Depo. of Tweddle, pages 169, 176; patent of Tweddle, page 445.)

It will be noticed that this process has no special application to any particular grade or gravity of oil. The burning oil and the lubricating, as ordinarily used, are merely arbitrary separations of the distillate, as it reaches the gravities desired; but the process is the same for all gravities of oil; the distillate in all cases being nearly odourless, not because it has been *deodorised*, but because the process of vacuum distillation practically prevents the formation of light offensive oils, if not entirely, at any rate sufficiently for all practical purposes.

If, as is usual, the lighter ingredients of the oil have been removed before the distillation proper is commenced, the distillate first obtained is burning oil, of about 45° gravity; and the distillate of the second run is lubricating oil, or neutral topaz oil, of about 35° gravity.

After the second run from the still, there still remains in the still a residuum which is dark green in colour, of heavy gravity, about 25° Beaumé, and good body, being an excellent lubricating oil, which, owing to its dark colour, is used chiefly for heavy machinery and for railroad axles.

There is no coke or tar in the still at the end of the operation,

which is a striking peculiarity of this method of distillation; so that the stills never require cleaning, and there is no waste product from the process.

The neutral topaz, or lubricating oil distillate above mentioned, contains more or less paraffine, depending upon the kind of crude oil from which it is made. This, if in sufficient quantity to require its removal, is extracted from the neutral topaz oil by chilling it with ice, and then squeezing out the paraffine in bags under hydraulic presses.

Other appliances of apparatus are employed by Dr. Tweddle to aid in the rapid vaporisation of the oil. His stills are furnished with perforated pipes through which the oil is introduced into the still, and is discharged over troughs which are also perforated and are furnished with serrated edges on the under side. The oil gathers in drops on the points of the serrated edges of the troughs, and drops therefrom on pipes heated with superheated steam. Thus the oil, running over the heated pipes in a thin film, is subjected to the action of a heated surface relatively large, which causes it to volatilise with great rapidity, and the more so as the pressure of the atmosphere has been removed from the interior of the still by means of an air pump. Thus he secures an exceedingly rapid evaporation. This process is facilitated by bringing jets of superheated steam from the pipes in contact with the oil flowing over the surface of the pipes.

Another modification of his apparatus consists in combining together two or more stills furnished, as above described, with steam pipes and troughs, by means of which distillation may be continued indefinitely for any desired length of time. This he is enabled to do, because, there being no deposit of coke or tar in the still, it never needs to be cleaned out.

When using two or more stills, the superheated steam is passed first through the last still of the series, so as to furnish the greatest heat for the distillation of the heaviest oils, and afterwards through the other still or stills; while the crude petroleum is introduced into the first still, in which the light oil is distilled over with steam which has passed through the other still or stills; the residuum of the first

still is then run into the second and treated with hotter steam, and so on, through two, three or more stills, according to the different grades or gravities of products to be obtained; and thus, as the residuum from one still passes into the next still, it is treated with a higher degree of heat.

At his Eclipse Works, Dr. Tweddle had a separate still *or vessel* for removing the benzole from the crude petroleum, before introducing it into his "cast-iron still."

In using this "cast-iron still," which is so frequently referred to, for the production of his several products, including the neutral topaz oil, he tells us (p. 197, cross 45–48), —

> "Sometimes the oil was introduced into the still continuously, "and dripped over the pipes as long as desired; we have, on a "few occasions, charged the still more rapidly until the still was "half full, but we still continued the distillation" (p. 197, cross 45).

There are three modes in which this cast-iron still was used by Tweddle, in making his burning oil, neutral topaz and heavy residuum, two of these ways most usually, and the third only occasionally.

1. Sometimes he ran the crude oil into the still and let it drizzle over the pipes, and when the light oil was distilled over, the residuum (heavy oil) was removed from the still. This residuum was then introduced into the still and drizzled over the pipes until the heavy oil (neutral topaz) was distilled over; and the residuum remaining undistilled was then removed.

2. At other times he ran the crude oil into the still so as to drizzle over the superheated steam pipes, while the burning oil was distilling over, allowing the unvaporised oil to collect in the bottom of the still, and when the still was full enough he stopped the supply of crude oil, and increased the heat sufficiently to vaporise the heavier or neutral topaz oil, leaving the heavy green oil in the bottom of the still.

3. At other times, though less frequently, he would fill the still at

once with a full charge of crude oil; and then first distil off the burning oil, and then the neutral topaz oil, leaving the heavy residuum in the still.

Tweddle, p. 197, cross 45–48.

The first mode was when "the oil was introduced into the still "continuously and dripped over the pipes as long as we desired" (p. 197, cross 45); when so used, the "usual practice was to keep "in the bottom of the still two or three feet of oil. If the operator "desired to do so, he could maintain a vacuum in the receiver and "withdraw the residuum continuously while the distillate was pass-"ing over to the condenser, or he could withdraw it intermittently if "he desired to do so" (p. 197, cross 48).

The second mode: sometimes the still was charged more rapidly until the still was half full, but the distillation was continued (p. 197, cross 45).

> "In such case, when we got the still filled up we might either "continue the distillation with the oil stopped coming in, or we "could, and used to, draw the heavy oil from the bottom of the "pan into the vacuum receiver by slightly lowering the vacuum "in the still and increasing the vacuum in the vacuum receiver, "until we had drawn a portion or the whole of the heavy oil "into the vacuum receiver; then increasing the vacuum in the "still, and lowering the vacuum in the vacuum receiver, we "again opened a connexion between the vacuum receiver and the "still, and sucked the oil into the still, and redistributed it by "means of the troughs over the pipes. This could be repeated "over and over again, as long as the operator deemed it "necessary; we did in fact use it in both of these ways at "discretion" (p. 200, cross 77, 78).

The third mode was when "we filled the still up at once with pe-"troleum the same as in ordinary fire distillation, first distilling off the "light oil, then distilling off the paraffine oil until the operator deemed "the charge sufficiently low. By light oils, I mean illuminating "oils" (p. 200, cross 79).

This last mode he says he used very seldom; and we ask attention to the fact that Mr. Merrill, speaking of this third mode of use, says that the process of distillation, and the products distilled over, are substantially those described in the patent of 1870 (p. 434, ans. 63 and 65). Now, if it be true, as suggested by the complainant, that the patent of 1870 shews a process and products distinguished by their *excellence* from those used and obtained in modes No. 1 and No. 2, how does it happen that an experienced distiller like Dr. Tweddle did not detect that great difference in the character of the products, and that he did not use mode No. 3, not very seldom, but very commonly? Will not the court infer that the neutral topaz oil which he produced at that same time by mode No. 1 and No. 2, did not differ in excellence from that which he produced by mode No. 3, the excellence of which the complainant in person takes pains to admit?

We also call attention, in passing, to the fact, which will serve to keep the court in mind of the true relation between the successive operations from 1864 down to the present time, that this mode of distillation, No. 3, was precisely the mode of distillation practised in 1864, 1865 and 1866, differing in apparatus by the perfection of the vacuum, and differing accordingly in the product by the perfection of distillation, without, however, the generation of thin offensive oils.

In the fall of 1867 he ordered, and in May, 1868, he began work with, two wrought-iron stills which are represented by model No. 35; these stills differ from the cast-iron still in shape, and in the number and arrangement of the superheated steam pipes, and in the height from the point of distillation to the goose-neck, matters of which we shall speak more particularly hereafter. These two stills and the cast-iron still were arranged to be worked in conjunction with one another, in a mode which is described in answer to the 188th cross-interrogatory, on page 211, by Dr. Tweddle, as follows: —

> "The crude petroleum was introduced into a still and heated
> "by steam, and the benzole, if there was any in the oil, was

"distilled off into its appropriate receiver. Steam and [or]
"superheated steam was admitted, or both, into the stills, by
"the proper pipes. A vacuum was produced in all of the stills
"by means of a large duplex pump. The heated crude oil was
"sucked into the upper still from the still where the benzole
"was taken off. It was distributed over the pipes, by means of
"the troughs, at such rate as the operator desired. In passing
"over the pipes, the illuminating oils were evaporated off; after
"a time, when the operator desired, the cock which connects
"the bottom of the upper still with the distributing pipe in the
"still below it, was partially opened, so as to permit the oil,
"which accumulated in the bottom of the upper still, to flow
"and be distributed, by means of the troughs, over the pipes
"in the second still, in which a higher temperature was main-
"tained. The oil, in flowing over the pipes in the second still,
"distilled over as paraffine or neutral topaz oil, from 38 to 32
"Beaumé. The illuminating oil which distilled from the upper
"still went over and was condensed in its condenser. One of
"the vacuum pumps was connected with this condenser, and
"pumped the illuminating oil to its appropriate tank. The
"vapours of paraffine oil from the second still were conducted to a
"separate condenser. One of the pumps was connected with it
"and pumped the paraffine oil to its appropriate tank. Some-
"times we ran from the second still to the third still, in which a
"still higher temperature was maintained, where a further por-
"tion of paraffine oil was distilled over. It also went to a
"separate condenser; but the product of paraffine oil was
"conducted by the same pump that pumped the paraffine oil
"from the second still, so that the paraffine oils from the second
"and third stills were mixed together when they reached the
"pump. The residuum was conducted by an appropriate pipe
"from the bottom of the third still to a vacuum receiver. I
"neglected to state that a pipe connected the bottom of the
"second still with the distributor in the third still, by means of
"which the oil was conducted to the troughs placed over the
"steam pipes in the third still. A cock on this pipe regulated

"the flow from the second and third stills. A cock is also "placed on the pipe which leads from the third still to the "vacuum receiver, to regulate or stop the flow. Pipes also "went from the bottom of each still to the vacuum receiver, on "which were placed cocks. A pipe led from the bottom of the "vacuum receiver back to, and connected with, the supply pipe "of each still; so that, if desirable, any oil in the receiver "could be brought back and distributed over the pipes in any "or all of the stills simultaneously or successively, as the oper- "ator desired."

These stills he continued to use together, in the manner above described, from May, 1868, until his refinery was destroyed by fire in June, 1870 (p. 212, cross 189). It will be observed that the mode of operation here described does not differ from the first and second modes, heretofore described, of using the cast-iron still by itself in the year 1867.

In all these various modes of using the apparatus, the process was substantially the same, and the result was the same, depending for its effect in producing sweet and nearly odourless distillates, on low temperature and rapid evaporation by steam and vacuum.

It is worthy of remark that this apparatus used by Dr. Tweddle at the Eclipse Works from May, 1868, did not differ in the principle of operation or in the result produced from that which he used at the Standard Works.

In the years 1864, 1865 *and* 1866, *at the Standard Works,*

He used an experimental apparatus with which he produced "from "crude petroleum by distillation *in vacuo* with superheated steam, "burning oils with very little odour compared with that from fire dis- "tillation, and heavy paraffine oils with very little odour, both of which "were almost devoid of the blue colour or fluorescence, and also pro- "duced a residuum, almost odourless, without tar or coke" (p. 162, ans. 64; p. 191, ans. 183).

Of the heavy paraffine oil so produced he says, "The colour was "yellow, something like olive oil, the density between 33° and 35°

"Beaumé, with very little odour; it was light; it was something like "what I now call the neutral topaz oil which I now manufacture;" and of the residuum he says, "It was dark greenish-brown, almost "inodorous, and viscid at ordinary temperature" (p. 163, ans. 69, 70).

It differed from Exhibit No. 54, which is his neutral topaz oil now made by him, only in having a little more odour; it had not been chemically treated, and it had the paraffine in it (pp. 168, 169, ans. 108, 112 and 113).

It will be observed that this process was conducted in a manner and with apparatus not substantially differing from that which the complainant contends to be especially described in the patent of 1870. The results, as might have been expected from the fact that he used an experimentally imperfect apparatus, were not as good *in degree* as those which he obtained in subsequent years; but they were the same *in kind* as these last, and they were sufficiently good in degree to form one of the inducements to his selling out at the Standard Works and to build the Eclipse petroleum refinery at the Sharpsburg bridge, where he undertook operations on his sole account as manufacturer, as is next described, p. 249, ans. 63.

See, in connexion with this, *Lombard*, p. 274.

In the year 1867, *to* 28*th June*, 1870, *at Eclipse Works, Sharpsburg bridge.*

He began to excavate for a crude oil tank at this place (tank of 20,000 bbls. crude petroleum); about December 20, 1866, ordered a vacuum pan, double vacuum engine, condenser, and all the other apparatus for a large refinery; vacuum pan finished May, 1867, and apparatus put in operation May or June, 1867 (p. 164, ans. 72, 77). This was the still known in the case as the "*cast-iron still*," and Exhibit 124 is a model of it made to a scale, except that the condenser is made one half length to save room, the condensing pipes being bent around instead of lying out straight (p. 479, ans. 76).

In this still he made, —

1. Burning oil, white high fire test, and totally devoid of the fluorescence and the objectionable odour which characterises ordinary fire-distilled burning oils. It was sold without further purification.

2. Paraffine oil, or neutral topaz oil as a distillate. Of this identical oil no sample can be produced which was made at [that] time, because all his samples were destroyed, as before stated, in the destruction of his house by fire, in October, 1867.

3. A heavy dark-green lubricating oil, 24° to 30° gravity (p. 192, ans. 193).

As to the odour of the neutral topaz oil, he says he does not consider it odourless, and never did (p. 170, ans. 122).

He continued to use his cast-iron still in the manner before described, until he put up two large vacuum stills, constructed as described in his patent of 10th December, 1867 (see Exhibit 35). These stills were put up in the fall and winter of 1867–8.

In these new stills he continued to manufacture his neutral topaz oil and other products in the same manner as before, until the Eclipse Works were destroyed by lightning on 28th of June, 1870.

In August, 1870, he resumed his operations at the Aladdin Refinery, using stills which he himself had built for the parties then running these works, and whose establishment he bought out in 1870, which stills were just like the wrought-iron stills above referred to as used at the Eclipse Works (p. 289, ans. 73).

There is no testimony whatever which proves that Dr. Tweddle ever used any other apparatus or process for making his neutral topaz oil than that which he himself states that he used; nor that he used it in any other manner. There was evidence offered to prove that he sometimes put a fire of benzine under his stills (see deposition of *Herman Keller*, p. 326); but the cross-examination proves that Keller really knew nothing about it, and Dr. Tweddle and his foreman, Clarke, state that Dr. Tweddle did this only when the steam superheaters were out of order, to supply the additional heat required. But this does not in the slightest degree militate against

the fact that Dr. Tweddle made neutral topaz oil in his cast-iron still, nor does it prove that there was anything in his process which prevented the production of neutral topaz oil just as he states.

Dr. Tweddle states that his neutral topaz oil sometimes received a slight chemical treatment to remove the still smell, and sometimes was merely exposed to the sun for this purpose. But the *still smell*, as we have already seen, is admitted to be different from the peculiarly offensive odour which Merrill's process is designed to remove, and is a smell which readily yields to chemicals.

Neither is there a particle of proof, nor even any attempt to prove, that Dr. Tweddle at any time attempted to deodorise his heavy distillate or neutral topaz oil, by placing it in a still and distilling from it the thin oil, the presence of which causes the offensive odour of ordinary distillates. This is Merrill's process, and we claim that the burden of proof is on the plaintiff to shew that Tweddle ever used it subsequent to the date of Merrill's patent. Instead of doing this, however, the plaintiff has endeavoured to shew that Tweddle could not have made his oil in the way that he says he did, and to discredit his statement as to his having made his oil at as early a date as he fixes. These allegations or insinuations we are fully prepared to meet; but in doing so, we insist that this line of attack has really no bearing upon the question at issue. If it be so that the process by which Tweddle now makes his neutral topaz oil, and has been making it since the date of plaintiff's patent, is no infringement of that patent, then it is no matter whether he cracks his oil or does not crack it, or whether there are or are not any light oils in it, or whether he did or did not make it in 1864, and ever since that time, substantially as he now makes it. Any doubt upon these points raised by the plaintiff's testimony does not in the slightest degree affect the question as to the present infringement of the patent, or relieve the plaintiff from the burden of proving such infringement. If Tweddle does not make his oil as he says he does, and as his workmen says he does and did, then let the plaintiff say how he does make it. If the plaintiff alleges that Tweddle must "crack" his oil, and that if he does crack it, it must have a bad smell, and that he must remove this smell in some way, is it not sufficient for the

defendants, in the absence of any proof to the contrary, to reply that Dr. Tweddle's oil is made without a bad smell, and therefore does not need any process of deodorisation?

THE PROCESS AND APPARATUS DESCRIBED IN TWEDDLE'S PATENTS AND USED BY HIM ARE OPERATIVE, AND RESULT IN THE PRODUCTION OF HIS NEUTRAL TOPAZ OIL.

A large amount of the testimony produced by the complainants, especially that which is of an expert character, is apparently intended to discredit defendant's proofs as to the mode in which the oil sold by them was manufactured, by raising a doubt as to whether it is possible by the process and apparatus employed by Dr. Tweddle to produce his neutral topaz oil.

It will be remembered, as we have already shewn, that Dr. Tweddle describes in detail the process by which he has always made his neutral topaz oil, from October, 1866, down to the present time, and that he distinctly attributes its neutral character solely to the employment of the process of vacuum distillation with superheated steam, invented by him and described and patented in his patent of 1862, re-issued in 1866; and while we confidently submit that this proof cannot be invalidated by any testimony produced by the complainant, we also with equal confidence insist that no amount of uncertainty as to the feasibility of Dr. Tweddle's process will amount to proof of infringement of the complainant's patent.

While, therefore, we shall proceed to demonstrate the entire sufficiency of Dr. Tweddle's process to produce the result stated, viz., neutral topaz oil, we claim the right to hold the complainant to the proof of infringement of his patent.

As we have seen, Tweddle's re-issue of his patent of 1862 claims distilling hydro-carbon oils, such as petroleum and other substances, under a vacuum, or partial vacuum, by the use of steam for producing the vaporisation of the article to be distilled, also the use of superheated steam, in combination with the employment of a vacuum,

or partial vacuum, for the distillation of petroleum, &c.; and we contend and insist that this process, conducted in other respects like ordinary fractional distillation, it is which not only produces the neutral topaz oil, but is the cause of its production; and further, that this process modified by Dr. Tweddle, as described in his patent of 1867, is that which he is using and has been using from May, 1867, to the present time. This is his assertion, and the correctness of the position that his product is due to the combined use of vacuum, steam and superheated steam, we purpose to sustain by reference to the testimony in this case.

It is hardly necessary to prove that the practice of *fractional* distillation is a well-known practice as applied to all modes of distillation, its peculiarity consisting merely in collecting the distillate in different receivers according to the gravity desired to be obtained.

Atwood, p. 38, ans. 51.

The effects claimed for the process of the combined use of vacuum, steam and superheated steam are, —

1st. That by the use of steam introduced into the body of the still, vaporisation can be effected at a lower temperature and with less decomposition of the oil.

2d. That by the use of superheated steam a more rapid evaporation can be effected and at a lower temperature than by fire or by steam alone, and that the additional heat can be applied or withdrawn instantaneously and applied with uniformity throughout the mass of oil.

3d. That by use of a vacuum in connexion with steam in the still (the pressure of the atmosphere being removed), the vaporisation of the oil takes place at a much lower degree of heat than is possible under atmospheric pressure; and further, that the vapours of distillation can be drawn off the still, and thus pass away from the influence of the heat, with very greatly increased rapidity.

4th. That by means of the rapid evaporation and quick removal

of the vapours from the action of the heat of the still, the distillation is effected without communicating to the distillate the offensive odours resulting from fire distillation, or any other odours than the "still "smell," which readily yields to chemical treatment.

5th. That the use of steam and vacuum increases the proportionate yield of heavy oil, and improves the physical character of the distillate.

That these effects are the legitimate results of the use of steam, superheated steam and a vacuum, is clearly proved by the testimony.

First, then, by use of steam, distillation can be conducted at lower temperature and with less liability to decomposition of the oil.

Atwood says (p. 440, ans. 17) that steam diminishes the cracking operation, "because it becomes a vehicle for transporting the vapours "out of the still at a lower temperature than they would otherwise be "removed under."

Merrill says (p. 513, ans. 15), "Steam used during the distillation "is a powerful preventive of cracking, and brings the vapours over "at a much lower temperature than is the case when fire distillation "alone is resorted to."

There is other testimony to the same effect, but that quoted is of the complainant and his experts, and is sufficient for our point.

Second, As to the effect of superheated steam: *Merrill* says in his patent (Record, p. 8), "When superheated steam is used, the "temperature is *much lower* than when the operation is conducted "without it."

Atwood says (p. 37, ans. 48), superheated steam is used to enable the distillation to take place at lower temperatures.

Third, As to the use of steam and vacuum.

Atwood says (p. 441) that the use of vacuum diminishes the boiling point of 38° petroleum from 40° to 100°, and that under atmos-

or partial vacuum, for the distillation of petroleum, &c.; and we contend and insist that this process, conducted in other respects like ordinary fractional distillation, it is which not only produces the neutral topaz oil, but is the cause of its production; and further, that this process modified by Dr. Tweddle, as described in his patent of 1867, is that which he is using and has been using from May, 1867, to the present time. This is his assertion, and the correctness of the position that his product is due to the combined use of vacuum, steam and superheated steam, we purpose to sustain by reference to the testimony in this case.

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1st. That by the use of steam introduced into the body of the still, vaporisation can be effected at a lower temperature and with less decomposition of the oil.

2d. That by the use of superheated steam a more rapid evaporation can be effected and at a lower temperature than by fire or by steam alone, and that the additional heat can be applied or withdrawn instantaneously and applied with uniformity throughout the mass of oil.

3d. That by use of a vacuum in connexion with steam in the still (the pressure of the atmosphere being removed), the vaporisation of the oil takes place at a much lower degree of heat than is possible under atmospheric pressure; and further, that the vapours of distillation can be drawn off the still, and thus pass away from the influence of the heat, with very greatly increased rapidity.

4th. That by means of the rapid evaporation and quick removal

of the vapours from the action of the heat of the still, the distillation is effected without communicating to the distillate the offensive odours resulting from fire distillation, or any other odours than the "still "smell," which readily yields to chemical treatment.

5th. That the use of steam and vacuum increases the proportionate yield of heavy oil, and improves the physical character of the distillate.

That these effects are the legitimate results of the use of steam, superheated steam and a vacuum, is clearly proved by the testimony.

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Atwood says (p. 37, ans. 48), superheated steam is used to enable the distillation to take place at lower temperatures.

Third, As to the use of steam and vacuum.

Atwood says (p. 441) that the use of vacuum diminishes the boiling point of 38° petroleum from 40° to 100°, and that under atmos-

pheric pressure it vaporises at about 400° Fahrenheit, and *in vacuo* about 70° lower. Thus "vapours under a vacuum expand very "much, so that the amount of vapour necessary to fill a given space "while under a partial vacuum is very much less than the amount "required when under the ordinary pressure of the atmosphere. "Consequently, if a given amount in weight is to pass out of a still "under a vacuum in a given time, it will have to pass correspond-"ingly more rapid than it would if under the ordinary pressure of the "atmosphere."

Dr. Tweddle says, p. 469, ans. 34, "In vacuum distillation the "temperatures are much lower than when distilling under atmospheric "pressure. Instead of retaining the vapours in the still for the pur-"pose of letting them condense and be decomposed, they are carried "over into the condenser as rapidly as they are evolved. The "rapidity of distillation with the lower temperature at which it is "carried on prevents decomposition. Were decomposition or crack-"ing feasible in a vacuum still, the pipes would be rapidly choked up "with carbonaceous matter; the transmission of heat to the oil in the "still would be prevented by the scale and coke filling up the "interstices between the pipes." Dr. Tweddle further explains the advantages of vacuum, and its effects in preventing decomposition, on page 231, ans. 206.

Dr. Hayes, one of complainant's experts, made a series of experiments on the effect of the use of fire and steam with and without vacuum, as compared with fire alone, of the results of which he has given us a tabulated statement on page 537 of the printed Record.

As to these experiments we shall have something further to say hereafter; but for the present we will accept the data furnished, for the sake of the argument.

This table exhibits the temperatures of the vapour, by the various modes of distillation experimented upon by him, as follows: —

When the distillate reached a density of 42° Beaumé, the temperatures were: —

When fire alone is used, about 590° Fahrenheit.
" fire and steam, " 457° "

When fire and vacuum are used, 460° Fahrenheit.
" fire, steam and vacuum, 361° "

This shews clearly that by the use of steam and *vacuum* the distillation was effected at a much lower temperature, even when fire was also used, than when steam and vacuum were not combined.

In the same table the difference of heat of the vapours, in obtaining lubricating oil of 38° gravity, is given as follows: —

Fire alone (exact temperature not given), over .	600°
Fire and steam, ...	493°
Fire and vacuum, ...	516°
Fire, steam and vacuum, ...	406°

Professor Silliman (pp. 91, 92) performed experiments in distilling crude petroleum, from which the naphthas were first removed, and found the temperature at the line of division between light and heavy oils to be, —

With fire, steam and vacuum, of 21 or 22 in. only,	430° F.
With fire and steam, ...	493° F.
But with fire and steam the temperature rose to .	640° F.

before the heavy oil was all over.

In both cases he says he obtained a heavy oil substantially like Merrill's.

The advantage of the employment of steam and vacuum as auxiliaries to distillation are thus strikingly illustrated, especially as regards the heavy oils; and it further shews to what a great degree the *decomposition* of the oil is prevented by the use of vacuum when combined with steam. Of this, however, we shall speak more fully hereafter.

There is no proof to shew that *fire* is useful in the combination; it is mentioned by Merrill, because he has used it in his experiments, and does not seem to have tested the use of steam and vacuum without fire, as to its results in this regard. And, moreover, the vacuum used by him and his experts is always too small to produce the full effects of the removal of atmospheric pressure.

Tweddle tells us that the more perfect the vacuum the more successful the result; and he always uses 27 to 30 inches (p. 171, ans. 127), while the experiments by the complainant's experts generally involved the use of a much less perfect vacuum.

Our position as to the effect of the Tweddle process — use of combined steam and vacuum — in producing the peculiar results which Tweddle claims they do, and the peculiar adaptability of these results to produce the neutral topaz oil, is further confirmed by the experiments made, chiefly by the complainant and his experts, in this case.

The experiments made by Professor Silliman, for example, and detailed on pages 91 and 92, of making deodorized oil from crude petroleum, are very suggestive in this particular. It will be seen that they substantially differ from ordinary distillation, only in the use of *rapid* distillation by *low* heat produced by fire and steam in one case (p. 91), and by fire, steam and vacuum in the other (p. 92).

In the experiment with fire and steam only (p. 91), we find he used crude petroleum of 42° gravity, from which the naphthas were first removed, and distilled the oil down to 38½° gravity, the distillate before that being burning oil, after that, down to 30½° gravity, heavy or lubricating oil. The heat was slightly increased by letting on more steam in producing the heavy distillate. This, he says, was substantially like Merrill's oil, but lighter in density — in other words, it was like Tweddle's.

He obtained twenty-five gallons of heavy oils; how much more burning oil and residuum we are not told.

In the experiment on p. 92, with *fire, steam and vacuum*, he used 148 gallons of the same gravity crude oil, 42° B.; the naphthas were first removed. He produced seventy-five gallons burning oil distillate to 37½° Beaumé, and forty-five gallons in heavy oil distillate to 33½° Beaumé, and this heavy distillate also, he tells us, is in all respects practically like Merrill's oil.

In this latter experiment, with fire, steam and vacuum, he produced a larger yield of heavy oil than with fire and steam without vacuum. He tells us (p. 93, ans. 16), that the reason was that he did not run the density down so low with fire and steam as with fire, steam and

vacuum. It was a pity that where this was an important element of the experiment, he did not apply the test. If he had done so, doubtless the effect would have been that he would have discovered that with fire and steam he could not obtain so much heavy distillate without ruining its neutral character as to smell and colour. Dr. Hayes' table above referred to proves that the quantity would not have been so great.

Now these experiments prove what Atwood, Hayes and Merrill admit, that the heavy oil can be removed from petroleum by distillation, without decomposition or the production of offensive odours.

Hayes, p. 77, q. 27.

Merrill, in his testimony (p. 69, cross 57, 58), admits that "the "process of distillation may be so conducted as to produce an oil con- "taining paraffine and lubricating oil, and free from these thin and "offensive oils referred to, by keeping the oil in the still, while under- "going distillation, at a temperature below that at which these thin "and offensive oils are formed by decomposition of the heavy oils." And that if the distillation be *carefully performed*, the oil after the naphthas and burning oils are removed will not contain the thin and offensive oils.

This admission goes to the extent that distillation of petroleum may be so conducted as not to produce the offensive odours, either in the burning oil or in the lubricating oil.

Dr. Hayes states (p. 77, q. 27) that he produced an oil "having "the character of Merrill's oil," by distilling crude petroluem by use of fire and steam, continuing the distillation and lifting over the vapours of heavy hydro-carbons in the last part of the process, without decomposing them, or decomposing them as little as possible.

In regard to this experiment it is worthy of notice, that Dr. Hayes was asked, by the form in which the question was put, to identify this process with Merrill's (see p. 77, q. 26); which, however, he declines to do.

It is difficult to suppose that Dr. Silliman and Dr. Hayes designed to be understood to say, that the oil produced by them in these experiments was Merrill's oil, or identical therewith, in respect to the manner in which the deodorisation is produced, but only in the fact

of the freedom from offensive smell; because they are speaking of the possibility of distilling petroleum without producing the offensive odour, which Merrill describes in his patent as "the disgusting odour "*peculiar to these oils*" (*i.e.*, heavy hydro-carbon oils), and which it is the object of his invention to remove.

It is clear from the statements in Merrill's patent as to the disgusting odour peculiar to heavy hydro-carbon oils, that when he got his patent he had no idea of the possibility of making heavy hydro-carbon oil distillate which should be free from such odour, without being subjected to a subsequent process of deodorisation. And we think also, that it is clear that neither Merrill, nor Silliman, nor Hayes knew of the possibility of doing this until they had seen Tweddle's patents.

Dr. Hayes' experiment of distilling crude petroleum by the use of fire and steam, without decomposing the oil, was repeated by him, with the modification of using fire, steam, and a *partial* vacuum, as stated on pages 77 and 86. He distilled crude oil by first removing the benzine, then the illuminating oil above 37° Beaumé.

> "I then continued the distillation with a comparatively low "heat, so that the heavier ingredients of the oil *should not be* "*decomposed*, but being vaporised, were carried over into the "condenser."

The *full details*, as he calls them, of this experiment, are very meagre (see p. 86).

By this means he produced an oil which he says (p. 78, q. 33) was "identical with the Merrill deodorised oil in colour and density, "the characters of most importance;" in reply to q. 31, he says it was *nearly* identical with the Merrill oil. By comparing these answers we must infer that there was a difference. If he had used Tweddle's process exactly, employing a more perfect vacuum and *superheated* steam, the result would have been the exact neutral topaz oil of Tweddle's, and he would then have, perhaps, avoided the production of any light odorous oil, which he speaks of in his reply to q. 35, and shews in Exhibit No. 20.

Dr. Hayes says (p. 83, cross 33 and 34), that "if the distillation "be conducted with certain auxiliaries, the offensive and peculiar "odours *are not produced* during the distillation of heavy oils;" "these agents act mechanically to lift over or waft over the vapours "of heavy oils as soon after they are formed as possible, before they "are decomposed, and also the exercise of unusual care during this "stage of the distillation."

He thinks, however, that in the distillation of the naphthas and the earlier stages of distillation of illuminating oils, the offensive odours are necessarily generated, but that the later stage of distillation of illuminating oil and the distillation of the heavy oil may be conducted without the formation of these offensive odours.

If this be correct, the fact still remains that after the illuminating oil is distilled off, the further distillation, viz., of the heavy oil, may be conducted without generating the offensive odours.

By Tweddle's process, with the use of steam, superheated steam and vacuum, he is able to distil off both the illuminating oil and the heavy lubricating oil without the formation of these offensive vapours, as is proved by the fact that both his distillates and his heavy green residuum are free from these odours, which if generated at all would betray their presence at some stage of the process.

In the experiments made by Dr. Hayes, Merrill took an active part. These experiments are designed apparently to disprove Tweddle's testimony that he carries on the distillation of his oil without destructive distillation or the production of offensive odours, either in his distillates or in his residuum.

The purpose is to create a side-issue which really has nothing to do with the case. The attack is on Dr. Tweddle's *theory;* the experiments do not disprove, but on the contrary establish, the fact that he makes his neutral topaz oil by the process described in his patents.

These experiments were conducted by Dr. Hayes and Mr. Merrill in the summer and fall of 1870 (after the commencement of this suit), and as appears from Merrill's testimony (p. 436, cross 2), were made at the Downer Works, of which Merrill is superintendent.

The apparatus employed (*Hayes*, p. 528, ans. 17; *Merrill*, p. 436, cross 3) was dissimilar from that employed by Tweddle in his

manufacture, in several important respects: it had a furnace for fire under it, having five feet of grate surface; whereas Tweddle *never* used a furnace under his still at all, although when his superheaters were broken he occasionally employed a benzine flame. This furnace was large enough for a still of 50 or 60 barrels, whereas the still they used was only four feet in diameter and two feet and a half high. The still was left exposed at the top to the air, instead of being bricked over, this exposure tending directly to promote the decomposition of the oil by the condensation of the vapour before leaving the still. They used a vacuum pump, but produced a vacuum of only 22 inches, whereas Tweddle finds it necessary to use from 27 to 30 inches of vacuum (p. 171, ans. 127). There was no sufficient means of superheating the steam employed, as this was attempted by passing it from the boiler and through a pipe 25 feet long and two inches in diameter, and Dr. Tweddle tells us (p. 479, ans. 74), that

> "It is absurd to suppose that the steam delivered through "such a pipe and into a vacuum could possibly have time to be "superheated. It was in fact introducing steam into the oil on "the inside of the still, cooling the oil down, while the fire on "the other side was being forced to keep the temperature up. " *The effect was, if any, to try and decompose the oil.*"

It will be noticed also, that the still used in these experiments was very small as compared with any still employed by Dr. Tweddle. It was evidently designed to be like Dr. Tweddle's cast-iron still; but if the experiments were intended as a test of the practicability of producing neutral topaz oil in the manner and with the apparatus by which Dr. Tweddle says he made it in 1866 and 1867, it is a little remarkable, to say the least, that the experiment was conducted in such flagrant disregard of the conditions employed by the Doctor.

In these experiments Dr. Hayes and Mr. Merrill used a charge of 148 gallons of crude petroleum of 42½° density, the naphthas having been previously removed by steam. They were conducted in four different ways; viz., —

By the use of

1. Fire, steam and vacuum.

2. Fire and vacuum.
3. Fire and steam.
4. Fire alone.

Merrill, p. 436; *Hayes*, p. 527.

Now it is a little remarkable, and very significant, that none of these experiments were made with *superheated steam*, any further than it would be superheated by passing through the oil, and that *fire* is employed in every instance.

The significance of this fact is shewn by Dr. Hayes' testimony.

He assumes that "cracking" takes place in all instances. *This is mere assumption*, and is disproved by the statement of Merrill that with the use of the apparatus described in his patent, he does not materially crack the oil in making his deodorised oil.

Merrill's testimony, p. 70, cross 69, and p. 71, cross 78.

Hayes further assumes that the relative amount of cracking is shewn by the relative amount of oil of lighter gravity than 38° Beaumé which is produced. He then states that the minimum proportion of cracking when distilling crude petroleum is obtained when using fire, steam and vacuum; the maximum by the use of *fire alone*, as proved by these experimental distillations, p. 528, ans. 20. The precise results as to the proportionate yield have been given already.

It will be noticed again that in these experiments he never tried steam and vacuum *without fire*. At the latter end of the distillation in these experiments the gravity of the oil decreased, but this is explained by the admission of Dr. Hayes (p. 529, ans. 23), that "this "cracking at the end of these distillations was due to decreasing the "speed at which the process had been conducted."

Why, we ask, did they thus *decrease* the speed of the distillation? It certainly was not fair, when the object of the use of superheated steam as described in Tweddle's re-issue patent of 1866 is stated to be to *increase* the heat so as to distil over the heavier oils.

In summing up the results of these experiments, Dr. Hayes says:

"The results briefly were that cracking of petroleum during "distillation is prevented with difficulty under *any* circum-

"stances, and that steam alone is a better auxiliary or preven-
"tive of cracking, when used in connexion with fire, than the
"vacuum, but that cracking takes place with both or either,
"*unless precautions were taken to prevent it*" (p. 527, ans. 16).

This we cannot but regard as a very unfair statement; because in the first place these experimenters did not use the necessary precautions to prevent cracking, but rather the reverse, as they used a disproportionally large furnace, they left the top of the still uncovered, and used a vacuum too slight to produce any valuable result. Moreover, if the object were to test the relative value of fire and steam and vacuum, they should have tried superheated steam and vacuum without fire, and then compared it with the use of steam and vacuum with fire. The fact is, that in none of the conditions did they dispense with the fire, and in none was the steam really superheated, and in none did they employ a sufficient vacuum.

If by the passage quoted Dr. Hayes means that the result with fire and steam alone is better than with fire and vacuum alone, we do not care to enter into the discussion, because Dr. Tweddle never used either fire and steam alone or fire and vacuum alone, and because, if, as we allege, the offensive vapour is caused by the use of fire heat to vaporise the oil, the use of the milder agent, steam, as an auxiliary to the fire, by vaporising the oil more rapidly, would have more effect than the use of vacuum *without steam*, as the oil must be vaporised before it can be carried off in distillation.

This tabular statement, however, clearly indicates the value of steam and vacuum, even when used, as in the case of these experiments, with a *large fire;* as with *fire alone* the density of the distillate (135 gallons) never sank below 37·2° Beaumé, and the heat was so much above 620° Fahrenheit that the thermometer failed to record it; while with *fire*, *steam* and *vacuum* the density was down to 37·5° at a heat of 406° F., when only 70 gallons of lighter oil had been distilled off.

But still further experiments were made by Dr. Hayes with Franklin petroleum, a very heavy gravity oil, being that which is used by Dr. Tweddle in making his neutral topaz oil.

With this oil and the use of *fire*, superheated steam and vacuum, the oils yielded only 9 per cent of light before reaching the low gravity of 30° Beaumé.

In this experiment Dr. Hayes *endeavoured to crack the oil*, and says he succeeded in doing so "by altering the speed at which the "process was continued" (p. 531); he adds, "In other words, it "was shewn, by the densities and other conditions, *that cracking* "*could be effected* on this stable petroleum, in a still where fire, "vacuum and steam were employed as auxiliaries."

There is a great effort to prove that these processes cannot be conducted without cracking, and then it is assumed that we must crack because we use them. It is also assumed that cracking produces the thin offensive oil which gives the bad smell to the distillate; and that this bad smell is one of the evidences that cracking has taken place.

Merrill, p. 521; *Atwood*, p. 505, cross 50.

If these assumptions are correct, and if it be assumed that Dr. Tweddle makes use of fire, steam and vacuum in making his neutral topaz oil, then it follows either that he cracks his oil and that it has a bad smell, or, *e converso*, that he makes an oil without a bad smell and does not crack it. But we have seen that he does make an oil which has not a bad smell, and surely we are entitled to the inference that he does not crack his oil, and does not generate the offensive smell in his distillate. How can this conclusion be avoided?

The reliance which the complainant puts upon the question of the cracking of the oil, is evidenced by his testimony in regard to the matter; we quote from page 521 of the Record:

"*Cross-Int.* 53. It is then a question of the degree to which "*cracking* has been practised in obtaining a given percentage of "paraffine lubricating oil, whether such oil shews more or less, "or any appreciable amount of the characteristic odours of thin "and offensive oil just mentioned. Is that so?"

"*Ans.* I think it is dependent upon the amount of decompo- "sition of the paraffine oil while undergoing distillation, thereby

"forming these thin oils, the *removal* of which, or the *absence* of "which, leaves an oil commercially deodorised."

"*Cross-Int.* 54. Does or does not the degree in which these "thin oils are formed depend upon the degree in which crack- "ing has been practised to obtain the oil in which they are "present?"

"*Ans.* It does depend upon the degree in which, or the ex- "tent to which, heavy oil has been cracked while distilling the "paraffine oil."

Merrill, however, admits that you cannot tell from the oil itself whether or not it has been cracked; he says (p. 521, cross 50), —

"I do not think any appearance or peculiar characteristic of "a lubricating oil would indicate whether cracking had been "resorted to, to produce illuminating oil."

Is not this a virtual admission that heavy lubricating paraffine oil can be made, as we assert it can, without cracking?

But the test of *perfect* freedom of our oil from offensive odour, or the absolute freedom from the existence of any volatile oils, is an issue which we do not accept.

Dr. Tweddle has never claimed that his oil is "as odourless as "granite," as Merrill does for his oil (p. 52, q. 13), nor does Tweddle claim that he can make it so. Whether the oil is "cracked" in Tweddle's process, is immaterial; all we do claim is, that the offensive vapours are not generated to such a degree as to injure his oils, and that by his process the production of these offensive oils is almost if not entirely prevented.

The real question is, does the proeess described in Dr. Tweddle's patents of 1862, 1866 and 1867 produce his neutral topaz oil?

We assert that it does; that the process he now uses, and to the use of which it is indebted for its peculiar characteristics, is simply the use of steam and vacuum which he patented in 1866; that it does not make a particle of difference, as to his right to continue to use his process, whether the oil is partially cracked or not. This is, as has already been said, a side-issue gotten up by the complainant

on the theory of Dr. Hayes, that a distillation of petroleum, in the earlier stages at least of the process, results in cracking the oil.

Suppose that Dr. Hayes is right in his theory, and that Tweddle is wrong. What then? We are not here to settle a question of theory; and error of our theory will not countervail the correctness of our practice. The result is the question.

If it should be true, as alleged by Dr. Hayes, that there can be no distillation of petroleum that does not involve cracking in the earlier stages at least, that is, during the first part of the run of illuminating oil, this does not in any way affect the heavy oil distilled over afterwards; and even on the theory of the complainant, it is clear that Dr. Tweddle's process must produce deodorised heavy oil.

Grant, for the sake of argument, that cracking does occur during the earlier stage of distilling the illuminating oil, and that offensive vapours or oils are then formed; these must go over with the distillate; they have always done so ever since distilling has been practised, and hence the trouble in producing an odourless distillate.

Now it is conceded by Dr. Hayes, that *after* the illuminating oil has gone over, together with the offensive vapours, the remaining heavy oil can be distilled over without forming any new offensive odours, by the use of proper auxiliaries, and that this heavy distillate will be nearly odourless.

See *Hayes*, p. 83, ans. 33.

This is just what is claimed by Dr. Tweddle for his process, and this brings us to the consideration of the fourth item in the enumeration of the peculiar effects produced by the combined use of vacuum, steam and superheated steam; viz., —

Fourth. That by using a low degree of heat (which is secured by the employment of steam and *superheated steam*), and with the aid of a *vacuum* by which he lifts over the vapours more rapidly and greatly increases the ebullition of the oil in the still, he is able to remove the distillate at a heat lower than that at which the noxious vapours are generated.

The theory that the offensive vapours or thin oils, which yield the

disgusting odour, are necessarily generated whenever the oil is decomposed, is conclusively proved to be erroneous by the experiment made by Mr. James Cuddy at Dr. Tweddle's works in June, 1872, as detailed in his testimony (p. 481 *et seq.*). The experiment clearly proves that by the use of superheated steam and vacuum (Dr. Tweddle's process), the oil cannot only be separated into oils of different gravities, but that it may be reduced in gravity and a large percentage of light oil produced of lighter gravity than the crude oil under treatment, without producing the disgusting odours, or injuriously affecting the heavy-gravity oil otherwise than by decreasing its proportionate quantity. This is done simply by distilling at the first more slowly and with a higher heat than is necessary to carry off the lighter oils existing in the crude petroleum.

In this experiment Cuddy used Franklin oil of 32° Beaumé gravity. The lowest ordinary gravity of illuminating oil is 38° to 40° Beaumé. This crude oil is therefore heavier to start with than the ordinary run of Merrill's lubricating oil.

Cuddy takes 25 barrels of this oil and runs it into the still, taking 25 minutes to do so.

The whole experiment lasts five hours.

The still is heated *without direct fire*, by superheated steam.

The stand-pipe or goose-neck was specially elongated three feet. This elongation favoured the decomposition of the oil.

Vacuum of 29 inches, afterwards increased at the latter stage of the operation to 30 inches, was employed.

From this crude oil Cuddy first distilled 25 per cent of illuminating oil, taking three hours in the process.

This oil was, at the heaviest, 38° B. gravity.

He next runs off 55 per cent of heavy or neutral topaz oil of 35° to 31½° gravity, taking 2½ hours for the process.

He had then remaining in his still 20 per cent of residuum, a heavy, dark-coloured residual oil of 25° Beaumé gravity.

It is argued that Cuddy must have cracked his oil in this experiment at Dr. Tweddle's works, because he used a 32° gravity petroleum, and produced as at first distillate (the benzoles having been removed) oil of 38° gravity, which is lighter than the crude oil he

started with, and then neutral topaz oil, also, at the beginning of the run, lighter than the crude oil. To this we reply that this does not follow at all, because the *gravity of the crude petroleum is only the average of the gravities of all its constituents.* Thus suppose he obtained, say, —

Illuminating oil,	25 per cent, 35·5°	(0·20+35·5)	= 8·87
Neutral topaz,	55 per cent, 33°	(0·40+33)	= 18·15
Petroleum,	20 per cent, 25°	(0·20+25)	= 5·00
	Average gravity,		32·02

And these are just the figures his experiment will give us.

This, we think, disposes of that argument.

They say that Cuddy must have cracked, because otherwise he could not have produced more than 9 or 10 per cent of illuminating oil, whereas he got 25 per cent.

To this we reply, that Hayes in his experiment (*Hayes*, p. 530, *Merrill*, p. 53) on Franklin petroleum (an experiment made 17th or 18th of June, 1873, after Cuddy had made and exhibited in evidence his experiment, made doubtless for the purpose of testimony in this case), used *fire* as well as vacuum and steam, and used a lower vacuum than Cuddy did; and in these respects he did not do as Cuddy did, and as Tweddle did and does, and that this is not another proof that (as Tweddle says in his patent of 1866) his steam and vacuum process increases the yield of illuminating oil.

The witness produces the results of this experiment, as follows: —

Exhibits Nos. 126 and 127, neutral topaz oil.
Exhibits Nos. 128 and 129, heavy residuum.

He also produces Exhibit No. 130, a sample of the ordinary neutral topaz oil on hand at Dr. Tweddle's works at that time.

As to the Exhibits Nos. 126 and 127 (neutral topaz made by Cuddy), Atwood says, "In the samples as they are, I find no *indications of cracking.*"

But Dr. Hayes tells us that there must have been "cracking."

That 25 per cent of light oil, 38° B., could not have been produced from this heavy Franklin oil without "cracking," as *he* could only get 9 per cent off before the oil ran down to 30° B. He fails to see that this experiment proves conclusively either that the oil was not decomposed, or that even if it were decomposed, or "cracked," as they call it, the ordinary result, as complainant claims, of "cracking," when fire is used *without* vacuum and steam (viz., the production of the offensive odours), is not attained where Dr. Tweddle's process is employed.

But this experiment does prove, we think, conclusively, that *even if cracking does take place in the use of Dr. Tweddle's process, it is not attended with the formation of thin offensive oils*, as is the case where ordinary distillation is practised.

It will be noticed that in this experiment no special care was taken to prevent the decomposition or cracking of the oil; the alteration of the apparatus by raising the stand-pipe, and the use of slow heat at first, all favoured cracking, and yet with all this, the resulting product is Dr. Tweddle's neutral topaz oil.

This experiment explodes all the complainant's theory of the necessary production of offensive oils when cracking is practised in the use of steam and vacuum, if Hayes was right in saying that the oil was cracked, and shews conclusively that the question whether cracking ever occurred in Dr. Tweddle's process is utterly immaterial.

The fact, however, remains that in the practice of Dr. Tweddle's process, cracking or decomposition of the oil is difficult of attainment, as stated by Hayes, and when the production of heavy oil is the object, is undesirable, because it decreases the relative yield of heavy oil; and Dr. Tweddle states that he never did so conduct the operation as to decompose the oil, that is, break up the heavy oil with oils of lighter gravity.

Thus whether or not offensive odours are generated by Dr. Tweddle's process, is evidently immaterial, if their presence is not to be detected either in his residual oil or in his distillate (neutral topaz oil). If these odours are generated, they must pass off without mingling with the distillate, which seems impossible, or they are pre-

sent in such small quantity as not to be detected by smell; certain it is, that the complainant's theory will not put them there.

If it is alleged that the absence of offensive odours in Dr. Tweddle's neutral topaz distillate proves that he does not employ his own process, we reply that his own uncontradicted testimony, that he uses no other process than that described in his patents, confirmed by the evidence of Clarke, is not in any way impeached by any of the theories or experiments of complainant or his experts; and that the fact that his process will produce his neutral topaz oil is clearly established by the experiment of Cuddy, and also by those of Dr. Hayes and Prof. Silliman, before referred to.

It does not follow as a logical or just conclusion that if Tweddle does not use his own process he does use Merrill's. The burden of proof is on the complainant to shew that Tweddle uses Merrill's process. And there is an utter absence of proof upon the subject. The only instance in which Tweedle ever used the practice described in Merrill's patent, is in the case of the Barren County oil, in which he made use of it long before it was ever invented by Merrill.

Tweddle, p. 163, ans. 71.

Fifth. The use of steam and vacuum in the distillation of petroleum increases the proportionate yield of heavy oil, and improves the character of the distillate.

This proposition is fully sustained even by the imperfect experiments of Hayes and Merrill before referred to, the results of which are tabulated on page 537 of the record.

First, as to the *quantity* of heavy distillate:

When the experiment was made with fire alone, the yield of lubricating oil (taking that oil to be all below 38° Beaumé) commenced after 120 gallons of lighter oil had been distilled over, and the remainder of the run, being lubricating oil below 38°, was not quite 16 gallons, the whole charge being 148 gallons.

When the experiment was conducted with *fire, steam and vacuum*, the heavy oil (below 38°) commenced to run when only 65 gallons

of lighter oil had been distilled over, and the remainder of the distillation was over 70 gallons of lubricating oil.

A comparison of these several experiments as stated in this table, gives us the yield of *burning oil* distillate to 38° gravity from 148 gallons of steamed crude petroleum of 42½° gravity:

With fire alone, . . .	120 gal.	81 per ct.
Fire and steam, . . .	90 "	61 per ct.
Fire and vacuum, about . .	86 "	58 per ct.
Fire, steam and vacuum, .	70 to 80 gal.	47 to 54 per ct.

These percentages shew the amount of burning oil produced, the percentage of heavy oil being proportionally greater as the amount of burning oil is less.

It is manifest that *fire* has an injurious effect on the production of heavy oil, and if steam and vacuum alone had been used, the result in favour of the yield of heavy oil would, we may infer, have been largely greater.

As to the *quality* of the heavy distillate:

By the experiment *with fire alone*, the heavy oil was from 37·8° to 37·2°, the average being 37·5° Beaumé. When *fire, steam and vacuum* were employed, the heavy oil was from 37·5° to 25·7°, the average being a little over 32° Beaumé.

Professor Silliman in his experiment (p. 91, ans. 14), with the use of fire and steam produced only 16¾ per cent of heavy distillate of 36° gravity, while with the use of fire, steam and vacuum (p. 92, ans. 15) he produced 33½ per cent of heavy distillate of 33½° gravity, shewing that even when fire was used with the steam and vacuum, the proportionate yield of heavy oil was nearly double that with fire, even when steam was also used, and with an increased gravity.

And the complainant himself states most distinctly the advantages of the use of steam and vacuum in improving the physical characteristics of the oil as a lubricant; he says (p. 415, ans. 7), —

"When the distillation reaches about 38° Beaumé, or when "the oil coming over begins to come coloured yellow, and from

"that on, until distillation is completed, there is a difference in "the *physical properties* of the oil distilled over, a difference in "the gravity of the oil distilled over, and the products of the "distillation are so far modified by the use of steam in connex- "ion with fire, and by the *use of steam, fire and vacuum in* "*combination*, that the oil distils over *more oily in body*, with "less decomposition or cracking, and but slight differences are "observed in the colour of the products distilled over."

This, it will be observed, is in the later testimony given by Merrill, in March, 1872, and shews how much he had learned during the progress of this case.

These facts and admissions stated by the complainant and his experts, prove, we think, conclusively the peculiar merits of Dr. Tweddle's invention, merits which they are slow to learn and acknowledge, but which fully sustain the Doctor's position. And if such results are obtained by an imperfect use of Dr. Tweddle's process, may we not safely draw the conclusion that his process is just what he claims it to be, and that the production of his neutral topaz oil is due, as we assert, to the combined use of steam, superheated steam and vacuum, which produces an oil substantially free from offensive odours and not deodorised, because it needs no deodorisation? It is, as we have before said, a process of *prevention*, and not of *cure*.

APPENDIX.

Before comparing the proved qualities of the Merrill oil with those of the better brands of paraffine oil in the market at the time of his invention, two points may be disposed of upon which an argument to shew substantial difference might be founded; viz., selling price and increased demand.

1. *As to selling price.*

The Merrill oil commands no higher price. Merrill himself puts in evidence samples of the "machinery" oil and the "spindle" oil made by the Downer Company by the old process, before his invention, the selling price of which was 50 and 60 cents, respectively. He also puts in evidence samples of his deodorised oil, unbleached 55 cents, and bleached 60 cents.

The Coffin and Lincoln oils, which were among the best paraffine oils in this market in 1868, brought about ten cents per gallon less than Downer's oil (made also by the old process) brought (*Yeomans'* dep. p. 116).

This difference is explained by the high reputation and great trade advantages of the Downer Company (dep. of Philbrick, p. 313, ans. to cross-int. 6).

2. *As to increase of sales.*

The Downer Company's sales of paraffine oil, before and after Merrill's invention, run thus (p. 49):

1860	$61,570
1861	33,478
1862	72,102
1863	136,804
1864	128,744

1865	$195,000
1866	148,753
1867	106,125
1868	276,222
1869	465,290

The sales, it will be observed, largely increased after the date of Merrill's invention. But was it in consequence of that invention?

Seccomb, Kehew & Thayer's sales of paraffine oil made by old process have also largely increased (p. 185, ans. 29).

So have *Coffin's* (p. 182, ans. 8).

So did Downer Company's by the foregoing table, while they were making paraffine oil only by the old method. Between 1861 and 1865, they increased *sixfold*.

This rate of increase, continued down to 1868 and 1869 (the two years which followed Merrill's invention), would more than account for the large sales in these years.

It therefore does not appear that they sold any *more* paraffine oil by Merrill's method than they would have done had they continued the old method.

It appears that in 1865, 1866 and 1867, the Downer Company's sales fell off. But this had nothing to do with complaints of the oil made by the old method.

Depo. of *Merrill*, p. 49, ans. 5.
" *Yeomans*, p. 107, ans. 30.

There *is* one point of superiority for *the purposes of the trade* which is enjoyed by the Merrill oil in consequence of its being comparatively "free from the characteristic odours of heavy hydro-"carbon oils," and also free from "fluorescence;" viz., that *dealers can adulterate the comparatively high-priced fatty oils with it, without detection.*

It is not pretended that it improves the fatty oils. Its value in this respect is simply its facilitating frauds upon purchasers by dishonest dealers.

See Merrill's patent, p. 8.
Depo. of *Yeomans*, p. 114, ans. 10.
" *Smith*, p. 16, ans. 21.
" *Squier*, p. 19, ans. 12.
" *Parks*, p. 22, ans. 12, 13.
" *Salmon*, p. 120, cross-ans. 40.
" *Maguire*, p. 42, ans. 10, 11.
" *Yeomans*, p. 106, ans. 29.

This is not "utility," in the sense of the law.

The Portland Oil.

The testimony upon this subject is the deposition of Atwood, a witness for complainant, and the superintendent of the company which manufactures the Portland oil.

We ask attention to the following passages from his deposition, p. 38.

On cross-examination he says, —

"*Cross-Int.* 52. In the same answer, viz., the sixty-fourth, "you say, 'In regard to the results, I have very much improved "the quality of our oil at the expense of the quantity made,' &c. "Has this improvement gone on gradually during the last seven "or eight years? *Ans.* It has. *Cross-Int.* 53. Do you make "now a hydro-carbon oil for lubricating purposes, substantially "free from offensive odour? *Ans.* Yes, sir. *Cross-Int.* 54. At "what point during the last seven or eight years did you begin to "make a hydro-carbon oil for lubricating purposes, substantially "free from offensive odour? *Ans.* I should call our lubricating "oil, during the whole of that time, substantially free from offen- "sive odour, but not free from odour. *Cross-Int.* 55. Has your "lubricating oil during the whole of that time been made with a "sufficiently good colour, and a sufficient body, for lubricating "purposes? *Ans.* Do you mean when applied alone, unmixed? "*Cross-Int.* 56. Please answer both ways, as to its use alone,

"and as to its use in combination with fatty oils. *Ans.* The "colour, — we have had very little objection to that. As to the "body, very few of our customers use it unmixed. They mix "it with fatty oils. *Cross-Int.* 57. You say that your lubricat- "ing oil has been, during the last seven or eight years, substan- "tially free from offensive odour, but not free from odour. Has "the odour which it has possessed materially affected its useful- "ness, or its salableness, as a lubricating oil? *Ans.* I could "hardly say that it has, for the reason that we have always had "a ready sale for all that we have made. *Cross-Int.* 58. In "making this oil, you say that you have improved the quality "of your oil, at the expense of the quantity made, preferring "to put a first-class article into the market in moderate quanti- "ties, rather than larger quantities of an inferior quality. Do "you mean that you sacrifice quantity to quality, by freeing the "oil more and more from volatile compounds? *Ans.* Yes, sir; "and by freeing it also from the thinner and lighter oils, that "might be used as lubricating oils."

On direct resumed, he says, —

"*Int.* 75. Do you consider the lubricating oil, which you "manufacture at the present time, as good as the oil manufac- "tured by the Downer Company under Merrill's patent? *Ans.* "As good in its lubricating qualities, do you mean? *Int.* 76. "Yes, and for all purposes for which they are respectively used. "*Ans. As a lubricating oil, I think it is; but not for mixing* "*with other oils, where it is desired that its own peculiar smell* "*shall not appear.* *Int.* 77. When you say, as a lubricating oil, "what do you mean by that expression, in this particular com- "parison? *Ans.* When the only object is a good lubricator, "without regard to odour, and without regard to the sale to "another party. In other words, with regard to its actual use." . . . . . "*Int.* 80. If after their removal there still remained "an odour, state what it was, and whether it would have been "desirable to remove that also. *Ans.* There still remained the "odour of the volatile oils, which were always present. It was

"certainly desirable to remove any odour arising from any "source."

On cross resumed, he says, "*Cross-Int.* 70. Comparing your "lubricating oil with the Merrill patent oil, you say you think "yours not so good for mixing with other oils, when it is desired "that its own peculiar smell shall not appear; and on your direct "examination you mentioned among the peculiarities of the "Merrill patent oil its greater freedom from odour. Do you "mean that it is freer from odour than yours? *Ans.* Yes, sir. "*Cross-Int.* 71. Is the odour which it has, of the same character "as that which yours has, but less in the degree? *Ans.* I "hardly think it can be said to be of the same character. It is "a different odour, I should say. *Cross-Int.* 72. How does it "differ? *Ans.* By being less tenacious; or, in other words, "one can be completely covered up with a smaller amount of "any other odour than the other."

Thus it is proved that the Portland oil, which is one of the best of the paraffine oils made by the old method, is *just as good for all purposes of a lubricating oil as Merrill's* is; it lacks the single recommendation to dealers that they cannot use it to defraud purchasers.

And it enables us to understand exactly what Mr. Atwood means when he says, speaking of the alleged Merrill improvement (p. 32, ans. 68), "I have known for the last few months that they had "effected a very essential improvement and an entire change in the "character of their lubricating oil;" and again, ans. 74, that he regards the production of the oil as "an important improvement in the "art," because it accomplished the removal of the volatile bodies and deodorised the oil.

It was an important improvement, but important to *dealers* only, and to serve a purpose which the law does not regard as a *useful* one.

Mr. Atwood also says that *the quantity that would be made from the crude oil used is very greatly increased* (p. 32, ans. 74).

If this is so, it is clearly a matter of *process;* and in regard to

that, we are not concerned to deny the merit of Merrill's process, as we insist that Tweddle's is substantially different therefrom.

The Seccomb, Kehew & Thayer Oil.

This oil has been manufactured since 1865, at Salem, Mass., *in three grades*, 24°, 27° and 32° or 33° gravity Beaumé, respectively. *They are sold exclusively to the mills* where they are to be used; not to dealers at all (dep. of *Thayer*, pp. 183–184, ans. 14–18).

Thayer testifies further, as follows: —

"*Int.* 27. Will you name now the principal mills which you "have supplied with your standard lubricating oils, stating as "nearly as you can the length of time during which you have "supplied them, the annual amount supplied them, and which "of the three standard lubricating oils you have supplied them? "*Ans.* The Cocheco Manufacturing Company and Print Works, "Dover, N.H., they had the 27 degrees gravity oil, I think, for "one or two years, and from 8000 to 10,000 gallons a year. "The Manchester Print Works, Manchester, N.H., the 27 de-"grees gravity oil, since 1865, I think, from 5000 to 9000 gal-"lons per year. The Naumkeag Steam Cotton Mills, at Salem, "Mass., the oil made from 32 degrees, for two or three years, "about 10,000 gallons per year. The Boston Manufacturing "Company, at Waltham, Mass., the 32 degrees gravity oil, for "about six years, say 6000 a year. I could name many other "mills if desired. *Int.* 28. So far as you know, have these oils "given satisfaction to the mills for lubricating purposes? *Ans.* "So far as I know, they have. *Int.* 29. Has your business in "these oils increased during the last four or five years? If so, "state generally the amount of such increase. *Ans.* It has "been constantly increasing. The last two years we have sold "all the capacity of our works would allow us to make."

Mr. Merrill puts in evidence (among samples of various paraffine oils, which he desires to contrast with his own, to their disadvan-

tage) a sample, of which, he says, "Exhibit No. 5 is a sample of "*Seccomb's Brilliant Paraffine Oil*, obtained from Mr. Francis Ma- "guire of Boston, and given to him, as he told me, by Mr. Thayer, "of the firm of Seccomb, Kehew & Thayer." *He produces no sample of any one of their three standard oils.* (And, by the way, although Mr. Thayer was asked — p. 189, cross 83 — if he would furnish the complainant with such a sample, and replied that he would, with pleasure, it does not appear that the complainant has called for it, or, if he has, he has not seen fit to produce it.)

This "brilliant" oil was not one of their standard oils. They never made but one lot of it, 700 to 800 gallons; and being of a very handsome *colour*, they used it mainly to bring up the colour of an inferior oil, which they also sold, and called their "common paraf- "fine oil."

The "brilliant" oil was only quoted at all in the "Commercial Bulletin" by the mistake of one of the partners. The standard oils were quoted in that paper.

Mr. Merrill does not appear to have been careful, in this case, to get a fair sample of the oil which he intended to disparage.

Depo. of *Thayer*, p. 184, ans. 19–26, 51, 59, 60–69.

The standard oils of Seccomb, Kehew & Thayer have been always made by the use of superheated steam, in connexion with fire heat, to vaporise the heavy oil in the still; they thus produce the paraffine oil, which has such a large and increasing demand at the mills.

Note that *the process of Tweddle* is *the same thing* done *in vacuum;* and that the complainant considers the use of vacuum to be only a modification of fire distillation.

The Lincoln Oil.

The defendants, Yeomans and Goss, also sell a paraffine oil, manufactured by Lincoln & Co., at Cambridgeport and East Cambridge, by the old process.

Yeomans, p. 180, ans. 3, 23.

This oil ranges in price from 42 to 65 cents per gallon.

Yeomans, p. 303, ans. 4.

It had been the principal extra lubricating oil sold by the defendants during the year preceding the time of giving their testimony.

Goss, p. 301, ans. 19.

We ask attention to the following answers upon the subject of this oil, taken from the testimony of *Goss*, one of the defendants (p. 301) :

> "*Int.* 21. What has been the result of its use in mills, so far "as you know? *Ans.* I should say it had been wonderfully suc- "cessful. *Int.* 22. Have you had any complaints from the mills "which have used it? *Ans.* I don't remember of a complaint. "Still there may have been. *Int.* 23. Into about how many "mills have you introduced that oil, and what kinds of mills "have they included? *Ans.* We have introduced it into about "every mill that we have any trade with for that class of oils, "including cotton and woollen mills. *Int.* 24. What proportion "of Dr. Tweddle's oil have you used for the last year, as com- "pared with Lincoln's? *Ans.* Scarcely any. *Int.* 25. Have "you used Lincoln's oil in preference to Coffin's, during the last "twelve months? If so, what has led you to do so? *Ans.* The "preference has been either an *advantage in the terms*, or a "personal preference as between the two manufacturers."

The complainants asked Yeomans if he would furnish them a gallon of this oil, and he replied that he would (p. 304, ans. 10). They have not undertaken to shew anything in disparagement of the testimony in regard to it.

It appears that the Merrill oil, mixed with lard oil, is used to some extent for *oiling wool*, in the place of olive oil.

So is that of Lincoln & Co. The following testimony will shew with what results (see *Yeomans*' depo. pp. 180, 181) : —

"*Int.* 9. Has your firm ever sold wool oils, consisting in part "of paraffine oil, to woollen mills; if so, since when have you "been selling them, and how have they been compounded? "*Ans.* We have sold them since probably some time in 1868. "We have used Merrill's patent oil, Tweddle's, and Lincoln's, "mixed, from fifty to seventy-five per cent of these oils, with "from twenty-five to fifty per cent fatty oils, elaine, so called; "elaine is an oil sold under that name in the market; contains "palm oil and tallow drips. It is made in the candle factories. "*Int.* 10. Have you ever had any complaints from customers "using the wool oil made of Merrill's patent oil and elaine? If "so, what was the complaint? *Ans.* I have had complaints; in "one instance only to an injurious extent, where the man com- "plained of the oil's smoking badly as the wools passed through "his pickers; he thought there was danger of fire in the use of "it; and I believe returned a part of the lot which he had not "used. *Int.* 11. If you sent that customer any wool oil after, "which was it? *Ans.* I have sent him both Tweddle's and "Lincoln's mixture since. *Int.* 12. Have you had any com- "plaint from him since? *Ans.* No. He has not complained, "although he has stated to me at different times that there was "some smoke still. I think that any one of the oils will do so "more or less. *Cross-Int.* 13. Who is the purchaser of whom "you have just been speaking? *Ans.* The firm is Colony, "Dickinson & Co., at Ashuelot, N.H. *Cross-Int.* 14. You say "you have sold wool oils, consisting in part of paraffine oil, "since sometime in 1868. Prior to that period, the oil sold "by you was not an oil for use in oiling wools, was it? *Ans.* "No, sir. *Cross-Int.* 15. What are your firm selling as a wool "oil at the present time? *Ans.* All three of the oils men- "tioned, and mixed, as I stated. *Cross-Int.* 16. What propor- "tion of your sales of wool oil consists in part of oil made by "use of Merrill's oil? *Ans.* I should say fully one half. *Cross-* "*Int.* 17. What proportion is compounded with Lincoln's oil? "*Ans.* About one half."

The Maysville Oil.

This oil was made by the old process from West Virginia cannel coal.

Wm. C. Chapin, agent of the Pacific Mills, Lawrence, says, that the Maysville oil was used for lubricating in those mills from 1864 to 1868, when it ceased to be manufactured, because it could no longer be produced as cheaply as the paraffine oils from petroleum, a manufacture which began in 1858, and rapidly increased (p. 97, ans. 8, 10).

He found it better than the sperm oil (which is the standard) in the last year, 1868 (ans. 14, 17).

There were individual complaints of its body and odour, but they were considered unimportant, and no attention was paid to them. There was no staining of goods; understanding by this, of course, stains which withstood bleaching. It was used throughout the mills, sometimes mixed with fatty oil, sometimes unmixed, and in each case it was satisfactory. *About five thousand gallons a year were used* (p. 98, ans. 18–30, 47–49).

By an excellent practical test, it was shewn that its lubricating quality was as good as that of sperm oil, and the quantity required was not any more than, if as much as, sperm oil (p. 100, ans. 42–45).

George F. Whiting, dealer in paraffine oils, sold the Maysville oil during the three years ending in 1868; during these three years it improved in body, colour and odour, and in the last year had less odour than any oil with which he was acquainted; occasional complaints were made of its lubricating quality or colour, which were "generally found to result from prejudice in regard to the use of "paraffine oils;" it was used either mixed (one fourth to one half fatty oil, the rest Maysville) or unmixed; and for all the purposes of a good lubricating oil, the Maysville, after it reached its best stage of manufacture, would, he says, give more general satisfaction than any other oil with which he is acquainted; its production ceased on account of the high cost of its production, petroleum having been introduced at a much lower price (pp. 101, 102; p. 103, ans. 38).

Wm. M. Bailey, Jr., an oil merchant, dealt in Maysville oil, 1862–1867; the business constantly increased till the manufacture ceased; "beginning with nothing, we got up to $20,000 per month, "average sales, which was principally oil;" "so far as we could judge, "it was considered the best in quality" as compared with other paraffine lubricating oils in the market; after the oil became known and established in the market, "the oil seemed to be almost universally "liked, and the customers who bought it were generally permanent "customers; the principal question in selling would be a question of "price merely" (pp. 129, 130).

Thomas Leyland was superintendent of the Maysville oil manufactory, and describes the process.

Ira Cowee, superintendent of Scituate Mfg. Co.'s cotton-mill for the last twenty-three years, used, as a lubricating oil, an oil bought from Bailey & Eaton (the Maysville, see pages 131, ans. 30). We quote from his testimony as follows (p. 142): —

> "*Int.* 8. State the circumstances of your beginning to use this "oil furnished you by Bailey & Eaton. *Ans.* In the first place, "they called my attention to it, but it was a new thing and I didn't "think much of it. Finally I agreed to give it a trial. I be- "came very well satisfied with the oil, considering it far better "than the other oil we had been using — sperm oil. We commenced "with it on our spindles, and went into the use of it gradually. "After our spindles we used it on our shafting and on the bear- "ings of our water-wheel. The oil that we had been using, the "sperm oil, gummed our machinery, and when we commenced "using this it cleaned it all off and the machinery ran lighter and "better. *Int.* 9. Did you make, or cause to be made, any "special observations with a view to determine whether there "was a saving in oil and in power by the use of the Bailey & "Eaton oil as compared with sperm oil? *Ans.* We did."

He afterwards says (ans. 13), the saving in power was from 12 to 18 per cent, and about the same in the quantity of oil. We quote also the following (p. 143), on cross-examination: —

"*Cross-Int.* 21. Please describe carefully how the tests were "conducted by means of which you ascertained the compara- "tive merits of the Bailey & Eaton and the sperm oils. *Ans.* "We have a mode of trying the water, by the proper machine, "to ascertain how much water it takes for the water-wheel, "sometimes by measuring the water below the wheel, and some- "times by measuring it on the gate. That's the way we ascer- "tain that fact. If the machinery runs easier, of course it takes "less water to run it. *Cross-Int.* 22. You have stated two ways, "as I understand you. Did you measure below the wheel or on "the gate? *Ans.* We tried it both ways. We are always try- "ing our water, or frequently. *Cross-Int.* 23. Was that the only "test to which you resorted in order to ascertain the compara- "tive merits of the oils? *Ans.* We ascertained in the early "part by comparing the relative prices of the oils and the amounts "consumed in a week or month. *Cross-Int.* 24. Did you com- "pare the amount of power required when using Bailey & "Eaton's oil with the amount of power required after thoroughly "cleansing your machinery and using sperm oil? *Ans.* We "did. It always took less oil while we got the Bailey & Eaton "oil. *Cross-Int.* 25. Did you mix the Bailey & Eaton oil your- "selves, or buy it mixed? *Ans.* We bought it mixed. *Cross-* "*Int.* 26. Do you know what it consisted of? *Ans.* They never "informed me how they mixed it. *Cross-Int.* 27. In testing "the different oils, did you at any time return to the use of "sperm after using the Bailey & Eaton oil? *Ans.* No, sir. "*Cross-Int.* 28. Did you cleanse your machinery before you "began to use the Bailey & Eaton oil? *Ans.* No, sir. We put "it right in after the sperm. *Cross-Int.* 29. When did you "cleanse it? *Ans.* We never cleansed it any more than we "always clean our machinery, once in six months. We clean "our spindles, &c., of course, every day or two. We never "cleansed it, we let one follow the other. We never have "changed our general practice in cleansing our machinery. "*Cross-Int.* 30. Mr. William M. Bailey took part in the tests "you made to ascertain the amount of power used and the

"amount of oil consumed with the different oils, did he not?
"*Ans.* No, sir. That was a part he did not have anything to
"do with. All supplies were ordered by him. He and Gov-
"ernor Smith were agents of the company. They never paid
"any attention to testing the power. They left all such things
"to me, and they said nothing to me about writing; it was the
"oil company that wrote to me, Bailey & Eaton."

Philip M. Millspaugh (p. 298), general agent of the Manhattan Oil Company, New York, has been twenty-three years in the oil business.

"Within the last four or five years [preceding November,
"1871], we have dealt in a good many kinds [of lubricating
"oils], taking sperm as a basis, then making other lubricating
"oils from such other oils as the price and trade required. *We*
"*do a greater lubricating oil business than any other three or*
"*four in the trade.*" "We have dealt in pretty much every kind
"of [petroleum oil lubricators] that has come before the pub-
"lic; have made experiments to test the different quantities
"[qualities?] of oils;" used Maysville oil for about three years as the principal paraffine oil that we used. Its character as a lubricator was one of the best substitutes we could get for sperm oil, for compounding with animal oils. We discontinued its use from three to four years ago. The reason we discontinued its use was because we could not obtain it at a price which would warrant us to use it; it cost too much.

The Coffin Oil.

Charles T. Coffin (p. 111) has manufactured the paraffine oil by the old process for the last six or seven years at South Boston. Some of it has been supplied to the mills directly by Coffin, marked "[B] Spindle Oil," the purchases being made by Joseph Barney; and some of it has been sold by Russell & Moore, oil dealers, Boston.

George W. Moore (p. 136) testifies that Russell & Moore get the Coffin oil directly from Coffin, and that sometimes it has his brand on it, and sometimes not; that in the year 1872 they sold between 700 and 1000 barrels of it to cotton and woollen mills for lubricating purposes; that they have sold it sometimes (about 20 per cent of their sales) unmixed, and the rest mixed with sperm or lard oil in the proportion of $\frac{1}{3}$ to $\frac{1}{2}$ lard or sperm; that they have sold it to 150 or 200 different mills; and that, to the best of his knowledge, it has always been satisfactory. He mentioned (ans. 30) the Neponset Cotton Company among those who have bought it unmixed.

Thomas B. Wattles (p. 147) is the superintendent of the Neponset Cotton Company. He says they use a paraffine lubricating oil, furnished by Russell & Moore, mixing it half and half with lard oil, and that "it has given perfect sastisfaction" (p. 148, ans. 12, 13, 18).

F. E. Clarke (p. 144) is manufacturing agent of the Pemberton Mills, Lawrence, manufacturing cotton and woollen goods. He is using, at those mills and at the Methuen Mills, a paraffine oil for lubricating, marked on the barrels "[B] Spindle Oil," bought from Joseph Barney, and stated by him to be Coffin's manufacture. He began using this oil at the Pemberton Mills in September, 1868, and at the Methuen Mills in the spring of 1869; up to the time of giving his deposition, February, 1871, that oil and no other had been used in those mills; about 110 gallons per week were used at the Pemberton, and about 25 gallons per week at the Methuen; at the Pemberton they first used it mixed with neats-foot oil, in the proportion of 75 per cent Coffin oil; about four months afterwards they began to use it unmixed, and since that time it has been used at both mills unmixed, on all the bearings in those mills except one large main shaft; he has observed no difference between the power required when using Coffin oil and the power required when using sperm oil; he has compared the two frequently, and found no difference in the quantity required per day or per week, and this although more of the Coffin oil runs off and is lost in the act of applying it than of the sperm oil; the result of the use of the Coffin oil, both mixed and unmixed, has been satisfactory; there has been no trouble from

odour; there has been "occasionally a slight deposit upon the win-"dows, but no serious inconvenience. We might have to wash our "windows once or twice oftener in six months than we would other-"wise." They have never had any complaints at either of the mills in regard to the staining of rubber goods while using their oil.

One witness, *Thomas S. Shaw*, for the complainant (p. 320), testifies that he used 39 gallons of Coffin's oil in 1869, and that it did not last more than about half as long as the Merrill oil. This is too imperfect a test to furnish any satisfactory answer to such testimony as that of F. E. Clarke, just referred to.

We have no disposition to disparage the Merrill oil in comparison with the better grades of the oils made by the old process; we contend only that it is no better for any *legitimate* purpose; that for the purposes of the *consumers* no improvement was required in the better grades of the old oils; although there was room for any great improvement, such as Dr. Tweddle has made *in the process*, viz., greatly increasing the yield of paraffine, and saving altogether the waste by forming tar or coke.

But to shew how the best of lubricating oils may happen to become the object of unfavourable judgment in a particular case, we refer to the evidence against the Merrill deodorised oils, given by —

Jonathan Smith (p. 149). He is agent of the Peabody Mills, Newburyport. He produces a sample (Resp. Ex. 27*a*) of "Downer "spindle oil," brought to him about the beginning of the year 1869, by a Mr. Lovering, who represented himself to be the agent of the Downer Kerosene Co., and who stated the oil to be "Downer's new "series of oils." Mr. Smith bought six barrels, according to this sample, and paid for them at the Downer Kerosene Co.'s office in Boston. The barrels were marked "Downer's Spindle Oils." He used it unmixed on all the bearings throughout the mill. The result was extremely unsatisfactory. The result of the use of a second lot, bought through Mr. Downer's son-in-law, was equally so. After using a small part of it, the oil was thrown out, and they took to using Yeomans' extra sperm lubricating oil, and have used it most of

the time since, and the result has been "mainly satisfactory. One "lot I sent back."

Yeomans' extra sperm lubricating oil is a mixture of sperm oil and Coffin's (or sometimes Lincoln's) paraffine oil. He at one time put in filtered oil into his mixture; but this was not done after the year 1868 (dep. of *Goss*, p. 300).

The Merrill oil is not free from the characteristic odour, colour or fluorescence of paraffine oils, only more so than some other oils.

Dep. of *Smith*, p. 16, ans. 18, 19.
" *Squier*, p. 19, ans. 14.
" *Squier*, p. 19, cross-ans. 19.
" *Atwood*, p. 41, cross-ans. 72.
" *Maguire*, p. 43, cross-ans. 5.
" *Yeomans*, p. 108, cross-ans. 48.
" *Merrill*, p. 50, ans 9.

Merrill's oil is heavy hydro-carbon oil produced by decomposition, or destructive distillation, of crude pretroleum, and differs from other such oils only in the fact that it is freer from colour and odour, but not absolutely free from either.

As a product, there is no standard by which to measure the degree of colour and odour which paraffine oil must possess to constitute it the same thing as Merrill's oil.

In their ultimate analysis all petroleums are composed of the same ingredients.

From the uncontroverted testimony in this case it is abundantly evident that heavy lubricating oils made from petroleum not only, but made, as Merrill's is, from the heavy offensive distillates of petroleum, were well known in the market long prior to the alleged discovery of Merrill, and that Merrill himself was manufacturing such oils prior to the time when he made his invention.

It is also clear that these oils had all the characteristic qualities of Merrill's oil; that some of them were substantially free from offensive odour, but not entirely free from odour. That they had been

SUPREME COURT OF THE UNITED STATES.

No. 209.

JOSHUA MERRILL, APPELLANT,

vs.

DAVID M. YEOMANS AND DANIEL J. GOSS, AS D. M. YEOMANS & GOSS.

SUPPLEMENTARY BRIEF.

SUPPLEMENTARY BRIEF.

The appellant's brief takes the following points upon the question whether the Merrill patent is for *a process*, or for *an article of manufacture*, irrespectively of the process by which it is made: —

1. That "manufacture" under our law always means "*article* manufactured;" and therefore the claim in this case for the manufacture is a claim for *the article*, however produced.

It is true that the act of congress describes the things for which patents may be granted, as arts, machines, manufactures or compositions of matter; and therefore nothing is patentable which is not one of these things. But *which one*, is immaterial. It is not necessary that the specification should say which it is for, or that it should say it is for either. Says Mr. Curtis (§ 27), "It is not necessary to the "validity of a patent, that the thing should be described with entire "accuracy as a 'machine,' or a 'manufacture.' If the thing itself is "correctly described, and it appears to be novel and useful, and unites "all the other requisites of the statute, *it may be left to general inter-"pretation to determine* whether the subject matter ranges itself under "the one or the other of these classes, or whether it partakes of the "characteristics of both."

The word *manufacture* is, in common speech about such matters, as often used in the sense of the *art of making*, as in the sense of the thing made. In which of these two senses Merrill uses it in his patent, must be determined by the context; *i.e.*, the whole specification must be taken together.

2. That Merrill uses the word "process" eight times in speaking of the *mode* of manufacture.

This is true. But the question is, whether he does not also use the word "manufacture" as an alternative expression for the same thing.

3. That the patent itself — *the grant* — says, "Whereas Joshua "Merrill, of Boston, Mass., has alleged that he has invented a new "and useful improved manufacture of deodorised heavy hydro-carbon "oils." But this title is given by the officers of the Patent Office. The language is theirs, not Merrill's. And it can be allowed no effect by way of construction of his own language used in the specification signed by him.

4. The appellant refers to the first sentence (see record, page 7), viz., "Be it known that I, Joshua Merrill, &c., have invented a new "and improved manufacture of deodorised heavy hydro-carbon oils, "suitable for lubricating oils for curriers' use; and I do hereby "declare that the following is a full and correct description thereof, "and of the mode of manufacture;" and speaks of this sentence as "expressly describing that manufacture as a new oil, and distinguish-"ing the description thereof from that of the mode of manufacture." We submit that this statement is too strong. We have already, in the principal brief, argued that the language quoted may just as well mean "a full and correct description of the deodorised heavy hydro-"carbon oils, &c., and of my new process for making them," and that *all of the rest of the specification* goes to shew that the latter is the real meaning. We will now add the suggestion (if a critical interpretation of the words of this particular paragraph is deemed important) that the more apt language to convey the meaning which the appellant assigns to the paragraph would be this: "have in-"vented a new and improved deodorised heavy hydro-carbon oil." The language actually used, "a new and improved *manufacture of* "deodorised heavy hydro-carbon *oils*," indicates a *single* mode of

manufacture by which *various* deodorised heavy hydro-carbon oils may be produced.

5. The appellant refers to this passage, in which the term manufacture is used: "It is not practicable to specify particularly the "specific gravity of the heavy oils used in my new manufacture;" and argues thus: "Here the term is used in the same sense as in the "opening paragraph, to designate the article. The heavy oils formed "the basis of the new oil, and might well be said to be used in it, as "a mechanic might speak of the steel used in a new file or drill." On the other hand, we have argued in our principal brief, that "the "well-known heavy offensive oils are not *used in* the patentee's "deodorised oil, but they are used in *the process by which* that deodor-"ised oil is produced." And strong confirmation of our view as against that of the appellants is found by examining the passage in question of the specification, taken as a whole. It is as follows: "It is not practi-"cable to specify particularly the specific gravity of the heavy oils "used in my new manufacture. These oils are well known to the "trade, and distinguished from the light burning oils and naphthas by "the term 'heavy oils,' their specific gravity varying greatly be-"tween the asphaltum oils and paraffine oils. Heavy hydro-carbon "oils produced from the same substances, vary considerably in "specific gravity, by reason of the presence of more or less of the "lighter oils which are always to be found mixed with them, and "therefore the percentage of oil that is to be distilled over in work-"ing this process will vary considerably." It seems plain that the heavy oils of *greatly varying specific gravity* cannot be said to be used in one and the same article of manufacture, deodorised oil, "as "a mechanic might speak of the steel used in a new file or drill." The file or drill is composed of the steel. The deodorised oil is *not* composed of "the heavy oils, well known to the trade, and of greatly "varying specific gravity." The very essence of the invention is in removing from the heavy oils, by distilling off, certain offensive constituents of them, amounting to a percentage of the whole which will

vary considerably according as the heavy oils subjected to the process are asphaltum oils or paraffine oils or oils of intermediate gravity.

6. The appellant refers to the following passage in the specification, near the foot of page 9 of the record, following a full account of the apparatus used in the process spoken of repeatedly by the patentee as "my process;" viz., "In carrying on my *new manufacture of deodorising* heavy oils with this apparatus, I place the "heavy oil to be deodorised in the still, and heat it by the fire "beneath to the required temperature to commence the operation;" and it may be added that he goes on to describe how he keeps up the heat, until he has distilled off all the volatile matters, amounting to from twenty to thirty per cent; and that the oil left in the still "has been so completely divested of its fœtid and pungent odours, "having only a slight smell like a fatty oil, and has become so oily, "as to be greatly improved and increased in value," &c. This passage first quoted, viz., "In carrying on my new manufacture *of* "*deodorising* heavy oils," &c., is certainly a very formidable one for the appellant. He admits — for he cannot help it — that the word manufacture is here used in reference to the process; but he says it is "*inadvertently*" so used, and that "this passage occurs in the latter part of the specification, in the description of the manner of "using a particular form of apparatus." But it is the apparatus described by the patentee as the preferred one, and no other mode of proceeding is described at all. We submit that the appellant, admitting that there is here a case exactly in point against him as to his use of the word manufacture, has entirely failed in his attempt to explain it away.

7. The appellant attempts to explain away the structure of *the claim itself*, which is for "the above-described new manufacture of deodor-

"ised heavy hydro-carbon oils . . . from heavy hydro-carbon oils, "*by treating them* substantially as hereinbefore described." And they contend that the claim should be read as though written "the above-"described new manufacture of deodorised heavy hydro-carbon oils ". . . *such as are made* from heavy hydro-carbon oils, by treating "them substantially as hereinbefore described." We submit that this is sheer *alteration*, not construction, of the claim. It is a perfectly intelligent and very common use of words to say, "the manufacture "of oils by treating them" so and so; just as we constantly say that the manufacture of such and such articles is by machinery or by hand, or is slow or rapid, or is easy or difficult; meaning by manufacture the art or process of manufacturing, and not meaning the resulting product. And it was in just this sense that we found the patentee using the word where he introduces his description of the process, by saying "in *carrying on* my new manufacture of deodoris-"ing heavy oils with this new apparatus, I place the heavy oil to be "deodorised in the still," &c., &c.

The appellant suggests that when the claim says "the new manu-"facture of deodorised heavy hydro-carbon oils . . . by treating them "substantially as hereinbefore described," the patentee is merely referring to the process employed, for the purpose of making more clear what is the character of the product or article which he claims; that is to say, it is a "deodorised heavy hydro-carbon oil, suitable "for lubricating and other purposes, free from the characteristic odours "of hydro-carbon oils, and having a slight smell like fatty oil;" and "the patentee, in order to make the description more definite, if "possible, refers to the described process of manufacture as furnish-"ing the oil to be taken as the standard of comparison." It would be a strange patent which, having described a process, should claim, as an article of manufacture, the thing produced by practising that process. The appellants excuse this extraordinary construction of their claim by saying, "It is very difficult to express in words the "exact differences between oils which physical examination shews to be widely different from each other." We submit that the law cannot recognise any such difficulty, and withholds a patent for an article of manufacture which does not admit of being described in words.

The real difficulty is, as we see elsewhere in this argument, not in describing the oil which the plaintiff's process produces, but in describing any difference, which the law will recognise as a patentable difference, between that oil and other oils previously well known in the market; a difficulty which fully accounts for the patentee's having described and claimed his invention as that of a new process of manufacturing oils.

8. The brief of the appellant says, "the language of the specification throughout shews clearly that the patentee believed himself to be the inventor of a new oil, differing in its physical characteristics "and its capacities for use from any oil then in existence." So far as this goes, we submit that a very different idea is conveyed by the following language of the specification describing the oil, on page 10: "It has been so completely divested of its fœtid and pungent odours, "having only a slight smell like a fatty oil, and has become so oily, "as to be *greatly improved and increased in value* as a lubricating "oil," &c.

In support of our own position, that the true construction of the patent is for an art or process, and not for a product, we ask the court to notice how the patentee, on page 8 of the record, after having described his process, and before going on to describe the apparatus which he prefers for the purpose, says, "I do not assume to know "the reason why the above-described process produces," &c. This passage, which is a very critical one in the specification, would be quite superfluous if the invention described was a new article of manufacture, and the process described had been merely put in to shew how the new article might be made; but it is a very important and instructive passage, if the invention described previously was a new process for producing heavy oils, &c.

But if we read the specification with reference to its successive

stages or divisions, and observe their relation to each other, we shall find the clearest evidence that the invention described was that of an art or process, irrespectively of the apparatus employed; not of an article of manufacture, irrespectively of the process employed. *First*, the inventor describes the well-known offensive heavy hydro-carbon oils. *Next*, he describes certain old processes by which it had been attempted to deodorise them. *Next*, *his* process for the same purpose. *Next*, he states what he believes to be the reason (though, he says, "I do not assume to know the reason,") why the process he has described produces heavy oils free from the characteristic odours of hydro-carbon oils. *Next*, he describes, by reference to drawings, the distilling apparatus he prefers to use in carrying out his invention. *Next*, he describes an apparatus for obtaining an improved operation as compared with the previous apparatus. Now it is highly improbable that if he had intended to patent *an article of manufacture*, *however made*, he would have described the process of making it, explained his view of the rationale of that process, described with drawings the apparatus which he preferred to use for working that process, and described with separate drawings special devices to be superadded to that apparatus, when all that the law required him to do, if he was patenting an article of manufacture, was to describe some *one* practicable way of making it.

But now we submit that, even construing the patent as for *an article of manufacture*, it must be so limited (besides those limitations as to the qualities the product must manifest, which we have elsewhere insisted upon) that no ground remains for the charge of infringement.

What is the article described? It is a heavy hydro-carbon oil, *deodorised;* an oil from which certain offensive elements previously contained in it *have been removed; not* a heavy hydro-carbon oil in which such offensive elements never existed, or from which, if they

exist, they have *not* been removed. As we have elsewhere shewn, the defendants' oil is not a *deodorised* oil at all, but a product of a peculiar mode of distillation of crude petroleum, so carried on that the offensive elements in question are never generated in the product, or, if so, in such slight quantities as not to require removal, and therefore is not and does not need to be deodorised.

It is necessary to observe carefully that part of the appellants' brief (page 11), where the attempt is made to escape from this plain distinction. The attempt is not a new one. It was made in the court below, and without success.

The appellants say, "It is evident that the patentee, by the lan- "guage of his claim, did not intend to restrict his invention or his "claim to oils produced from the *heavy* hydro-carbon oils which he "describes as being well known to the trade, for in the passage im- "mediately preceding the claim he points out that his invention will "be used if distilled hydro-carbon oils are used, which are different "from those known as *heavy* hydro-carbon oils, that is, oils from "which the lighter burning oils and naphthas *have not been removed*."

Now the language of the passage in the specification here referred to is this (page 10): "It will also be evident to those skilled in the "art that my invention will be used if the above-mentioned process "be worked to produce the deodorised heavy oils above described "from *distilled* hydro-carbon oils, from which the lighter burning "oils and naphthas have not been separated, *so long as they contain* "*heavy oils*, because the naphtha and lighter oils will go over first, "*leaving the heavy oil in the still to be operated upon.*"

In order to make himself a bridge to cross from the Merrill invention to the Tweddle process by which the defendants' oils were made — to cross from deodorised heavy distillate to an undistilled residuum, requiring and receiving no deodorising treatment — the appellant tries to shew, by the passage above quoted, that "Merrill did not mean to "limit himself to the use of heavy hydro-carbon oils known as such, "and to the simple removal of the volatile matters commonly associa- "ted with them;" because, he says, if the lighter burning oils and naphthas have not been removed, the oil is not a *heavy* hydro-carbon oil, technically so called. But the passage quoted from the specifica-

tion shews that the material referred to is the heavy oil containing the offensive elements in question, *plus* lighter burning oil and naphtha; in other words, a distillate in which the naphtha vapours, the lighter or burning-oil vapours, and the heavy-oil vapours have all gone over into one condenser, and been condensed there together; and this mixed distillate, being subjected to Merrill's process of fractional distillation, first the naphtha will be vaporised and removed again, next the light or burning oils will be vaporised and removed again, and then there will be left in the still to be operated upon precisely that heavy hydro-carbon oil which it is the object of Merrill's process to deodorise; *i.e.*, to rid by fractional distillation of those offensive volatile elements in it which had been generated by the high temperature required to raise that heavy oil in vapour, in the first place, and produce it *as* a distillate.

And with the same view of making out an apparent analogy between the Merrill process and that of Dr. Tweddle, by which the defendants' oil is made from crude petroleum, the appellant says this, at page 11 of his brief: "When crude petroleum is used, the naph-"thas and lighter oils are first removed, leaving the heavy oils in the "still, which form the deodorised oil, and which is deodorised by the re-"moval by distillation of the lighter bodies which render it offensive. "The only difference in the two cases is, that with petroleum the re-"moval of the naphthas and light oils and the deodorising is effected "before the heavy oil is separated from the paraffine and tarry mat-"ters, while with distilled oils, from which the naphthas and light "oils have not been removed, the separation from the paraffine and "tarry matters has been effected."

This paragraph abounds in suggestions liable to mislead.

In the production of neutral topaz oil by Dr. Tweddle from petroleum, the naphthas and lighter oils are indeed first removed, and *a* heavy oil is left in the still; but not *the* heavy oil to the deodorising of which the Merrill invention relates. The latter is a heavy oil which has been distilled, and, *by the act of being distilled*, contracted certain offensive light bodies or oils; while the former is a heavy oil which has not been distilled, and consequently has never contracted such offensive light bodies or oils, and which is afterwards vapor-

ised (for the purpose af separating the paraffine and tarry matters) in a peculiar way, so that no such offensive light bodies or oils are generated therein.*

The paragraph in question, quoted from the appellant's brief, suggests a false distinction; viz., between oils from which the lighter burning oils or naphthas have been removed, and those from which they have not been removed. This is not the question upon which turns the character of the heavy oils, to the treatment of which Merrill's process relates. Those heavy oils are such as (whether the lighter burning oils or naphthas have been removed from them or not) are *distillates;* viz., the condensed vapours of a previous distillation conducted under such conditions as to generate in the distillate the offensive light bodies or oils.

The paragraph on page 8 of the record, beginning with the words "I do not assume to know the reason," &c., places this beyond all doubt. Nothing in this case is clearer than that the Merrill specification proceeds upon the assumption that heavy hydro-carbon oils could not be produced, except by distillation, under such conditions as to generate such offensive light bodies or oils, and undertakes nothing more than to provide a mode of removing them.

When the appellant's brief says (contrasting Merrill's process of working upon a heavy distillate, and Tweddle's process of working

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*The Merrill process and the Tweddle process are said to differ only in this, that Merrill vaporises his heavy oil and separates it from the tarry residuum near the beginning of his process, while Tweddle does it near the close. Let us see:

Merrill	*Tweddle*
1. Removes naphthas and light oils, if there are any, from the heavy oil.	1. Removes naphthas and light oils from crude petroleum.
2. Vaporises *his* remaining heavy oil, and separates the tar and paraffine.	2. Vaporises *his* heavy oil, and separates the remaining tar and paraffine.
3. Distils off the light volatile oils until he gets his deodorised oil as a residuum.	*Does nothing further.*

Merrill so conducts his second step, viz., vaporising the heavy oil, that light volatile oils are generated, and so he needs to take his third step, viz., distil them off.

Tweddle so conducts *his* second step, viz., vaporising the heavy oil, that light volatile oils are *not* generated, and so he *does not* take Merrill's third step at all.

upon crude petroleum), "with petroleum the removal of the naphthas "and the light oils, and the deodorising, is effected before the heavy "oil is separated from the paraffine and tarry matters; while with dis- "tilled oils from which the naphthas and light oils have not been re- "moved, the separation from the paraffine and tarry matters has been "effected," it states (except that in the case of Tweddle's oil there is no deodorising at all) the truth indirectly and in a misleading disguise. The separation of the heavy oil from the paraffine and tarry matters is accomplished *only after, and as a consequence of*, distillation of the heavy oil; therefore in the one case, we have a heavy oil consisting of the condensed vapours of distillation, and in the other case, a heavy oil which has never been raised in vapour; therefore when the appellant's brief says, "the only difference in the two cases" is that with petroleum the naphthas and light oils are removed before, and with distilled oil are removed after, the separation of the paraffine and tarry matters, that is no more than to say that in the one case the heavy oil has not been distilled and offensive light oils have not been formed, and in the other case it has been distilled and such offensive oils have been formed. The question whether the naphthas and the light oils have or have not been removed, is absolutely immaterial. Whether the heavy oil which we speak of their being removed or not being removed from, be the heavy oil to which Merrill's invention relates, or the totally different heavy oil to which Tweddle's process relates, is the real question.

The appellant's brief states "that when petroleum is used the of- "fensive odours are formed and removed in the same manner as "when using heavy hydro-carbon oil." If this statement means that as petroleum is used by Dr. Tweddle for the manufacture of the defendants' oils, "the offensive odours are formed and removed in the "same manner as when using heavy hydro-carbon oils," *it is not true*. If it means, as we suppose it does, nothing more than this, that at the close of the operation of removing light oils from petroleum, there *begin to be formed* offensive oils which infect the heavy residuum in the still, it may be true. But in Tweddle's process such of-

fensive oils are inconsiderable in quantity, and *are never removed at all.*

The appellant's brief, on page 12, still further confuses the question as to the real character of the Merrill process, by saying "an equally "important part of the process is preventing the formation of such "odorous bodies." This is with a view to argue that the Tweddle process, which goes to the preventing of the formation of any odorous or offensive bodies, is the same process as Merrill's. But Merrill's "prevention" amounts to nothing more than this, that, taking heavy oil distillate as the material to be treated, which, by virtue of the high temperature necessary to make it a distillate, had offensive oils generated therein, he applies to such distillate a lower temperature, such as will vaporise and carry off the offensive or thin oils, and will not vaporise the remaining or residual heavy oil. In other words, in deodorising his heavy oil by fractional distillation, he takes care not to have a temperature high enough to make any new offensive oils of the same kind he has been removing.

As to the argument on page 12 of the appellant's brief, that the discovery (if it was Merrill's) that the offensive odours were due to the presence of volatile oils, capable of being removed by fractional distillation, entitled him to patent any process which produced oils free from such offensive volatile oils, it is sufficiently answered upon page 19 of the principal brief for the appellees.

We have argued in this case for the same construction of the patent for which we contended in the court below; viz., that the claim is for *the process.*

The appellees argue here, as they did below, that the claim is for *the article,* irrespectively of the process.

The court below adopted a construction different from either of these, but which, like the first, results in the dismissal of the bill; viz., that the claim is for *the article made by the described process.*

Judge Shepley's opinion says, "This, it appears to us, is what Mer-
"rill has claimed, a heavy hydro-carbon oil having the characteristics
"described in the patent, and produced by the treating the oils in the
"manner described in the patent. *He made his claim as if he believed*
"*that his oil could only be made by his process;* and if such was his
"belief, the evidence has not fully demonstrated to our satisfaction
"that he was not justified in that belief. The construction we have
"given to the claim is *the only one which appears to us to be admis-*
"*sible, and the only one consistent with the language used by the pa-*
"*tentee, and one which most effectually, probably, secures to him the*
"*product of his invention.* The thing patented and covered by the
"first claim in the patent is, consequently, a heavy hydro-carbon oil
"produced from heavy hydro-carbon oils, *themselves the product of*
"*distillation, and having the offensive odours peculiar to petroleum*
"*distillates*, such patented heavy hydro-carbon oil being so far de-
"odorised as to be free from the characteristic odours of heavy
"hydro-carbon oils, and having a slight smell liko fatty oil, suitable
"for lubricating and other purposes, *and the product or result of the*
"*treatment described in the patent.*"

In arriving at this construction, the court below apparently took into view, not only the language of the patent, which repelled the notion of a claim to *the article* however made, but also the fact that, for all practical purposes, no difference appeared *in the oil* from previous known oils produced by different processes (see our brief, p. 136, and appendix generally); and that unless the claim was limited to *the oil as produced by the described process*, involving certain alleged *economies*, it could not be sustained as new.

And it may be a more beneficial construction for Merrill than the construction for the process only, insomuch as it appears to give him a remedy against vendors of the oil as well as makers.

It is sharply attacked by the appellant on the ground that it establishes a class of patentable invention which is not known to the patent law. But this is precisely where, as we suppose, the construction in question is safe against attack. See the case of Goodyear Dental Vulcanite Co. *v.* Smith, decided at the present term of this court, where the claim of the Cummings patent to "the plate of

"hard rubber or vulcanite, or its equivalent, for holding artificial "teeth, or teeth and gums, substantially as described," was held to be for "a product or manufacture made in a defined manner."

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for the Appellees.